



BACHELOR OF SCIENCE PROGRAM
IN
MATERIALS SCIENCE AND NANOENGINEERING
(INTERNATIONAL PROGRAM)

FACULTY OF SCIENCE
MAHIDOL UNIVERSITY

REVISED PROGRAM OF ACADEMIC YEAR 2019

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Degree Bachelor Master Doctoral
TQF 2 Bachelor of Science Program in Materials Science and
Nanoengineering (International Program)

Faculty of Science
School of Materials Science and Innovation

Program Specification

Bachelor of Science Program in Materials Science and NanoEngineering (International Program) Revised Program of Academic Year 2019

Name of Institution Mahidol University
Campus / Faculty / Department Faculty of Science / School of Materials Science and
Innovation

Section 1 General Information

1. Code and Program Title

In Thai : หลักสูตรวิทยาศาสตร์บัณฑิต สาขาวิชาวัสดุศาสตร์และวิศวกรรมนาโน
(หลักสูตรนานาชาติ)

In English : Bachelor of Science Program in Materials Science and Nanoengineering
(International Program)

2. Degree Offered and Field of Study

In Thai Full Name : วิทยาศาสตร์บัณฑิต (วัสดุศาสตร์และวิศวกรรมนาโน)
Abbreviation : วท.บ. (วัสดุศาสตร์และวิศวกรรมนาโน)

In English Full Name : Bachelor of Science (Materials Science and Nanoengineering)
Abbreviation : B.Sc. (Materials Science and Nanoengineering)

3. Major Subject (If Applicable) None

4. Total Credits Required

Plan A - no less than 133 credits of courses taken while studying at Faculty of Science,
Mahidol University.



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Plan B - no less than 83 credits of courses taken while studying at Faculty of Science,
Mahidol University no less than 96 credits taken while studying at University of
Technology Sydney (equivalent to 54 Mahidol credits)

5. Program Characteristics

5.1 Degree Level Bachelor's Degree, four-year program

5.2 Type of the Program Academic program

5.3 Language Recruitment English

5.4 Admission Thai and International Students

5.5 Collaboration with Other Institutions

University of Technology Sydney, Australia

5.6 Degree Offered

Plan A - one degree (B.Sc. in Materials Science and Nanoengineering offered by Mahidol
University)

Plan B - double degree (B.Sc. in Materials Science and Nanoengineering offered by Mahidol
University and B.Sc. in Nanotechnology offered by University of Technology Sydney,
Australia)

6. Record of Program Status and Approval / Endorsement

6.1 Revised program of academic year 2019. The program was last revised in 2016.

6.2 Program starts: Semester 1 Academic Year 2019

6.3 The SC Faculty curriculum screening procedure committee approved the program in its
meeting no. 6/2019 on December 12, 2018.

6.4 The MU curriculum screening procedure committee approved the program in its meeting
no. 6/2019 on March XX, 2019.

6.5 The Deans approved the program in its meeting no. XX/2019 on April XX, 2019.

6.6 The MU council approved the program in its meeting no. XXX on April XX, 2019.



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7. Expected Date for the Implementation of Program under the Thai Qualifications Register (TQR) Record

The program will be ready to publicize its quality and standards according to National Qualifications Framework for Higher Education in Thailand in academic year 2021 (2 years after program starts).

8. Career Opportunities after Graduation

Graduates of the Bachelor of Science Program in Materials Science and Nanoengineering can find employment in

- 8.1 Entrepreneur in the field of Materials Science and Nanoengineering
- 8.2 Consultant and specialist in the field of Materials Science and Nanoengineering
- 8.3 Lecturer or Researcher in the field of Materials Science and Nanoengineering
- 8.4. An employee in any famous company which require knowledge in the field of Materials Science and Nanoengineering

9. Name, Surname, Identification Number, Academic Position, Educational Qualifications, and Academic Works published in the past 5 years of the Instructors Responsible for the Program

No.	Name-Surname	Academic Position	Degree (field)/ Institute/ Graduation year	Most recent Academic Works in 5 years
1	Mr. Rakchart Traiphol National ID 348020010xxxx	Asst Prof	- Ph.D. (Chemistry), Clemson University, USA: 2003 - B.Sc. (Chemistry), Khonkaen University: 1996	Potai, R., Faisadcha, K., Traiphol, R., Traiphol, N. Controllable thermochromic and phase transition behaviors of polydiacetylene/zinc(II) ion/zinc oxide nanocomposites via photopolymerization: An insight into the molecular level (2018) Colloids and Surfaces A: Physicochemical



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No.	Name-Surname	Academic Position	Degree (field)/ Institute/ Graduation year	Most recent Academic Works in 5 years
				and Engineering Aspects, 555, pp. 27-36.
2	Ms. Chayanisa Chitichotpanya National ID 310201121xxxx	Asst Prof	<ul style="list-style-type: none"> - Ph.D. (Materials Science and Engineering), University of Rochester, USA: 2004 - M.Sc.(Materials Science and Engineering), University of Rochester, USA: 1997 - B.Sc. (Chemistry), Chulalongkorn University: 1992 	Chitichotpanya, P., Pisitsak, P., Chitichotpanya, C. Sericin-copper-functionalized silk fabrics for enhanced ultraviolet protection and antibacterial properties using response surface methodology (2018) Textile Research Journal, 89, pp. 1166-1179.
3	Mr. Pongsakorn Kanjanaboos National ID 195990003xxxx	Asst Prof	<ul style="list-style-type: none"> - MS-PHD. (Physics), University of Chicago, USA: 2013 - BA (Physics and Economics), Washington University in Saint Louis, USA: 2008 	Boonthum, C., Pinsuwan, K., Ponchai, J., Srihirin, T., Kanjanaboos, P. Reconditioning perovskite films in vapor environments through repeated cation doping (2018) Applied Physics Express, 11 (6), art. no. 065503.
4	Mr. Tanant Waritanant National ID 165990010xxxx	Lecturer	<ul style="list-style-type: none"> - Ph.D. (Engineering), University of Manitoba, Canada: 2017 - M.Sc. (Optics and Photonics), National Central University, Taiwan: 2011 - B. Eng. (Electronic) Chulalongkorn University: 2009 	Nadimi, M., Waritanant, T., Major, A. Thermal lensing in Nd:GdVO4 laser with direct in-band pumping at 912 nm (2018) Applied Physics B: Lasers and Optics, 124 (8), 170.



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No.	Name-Surname	Academic Position	Degree (field)/ Institute/ Graduation year	Most recent Academic Works in 5 years
5	Mr. Yodchay Jompol National ID 319080012xxxx	Lecturer	- Ph.D. in Physics, University of Cambridge, UK: 2008 - M.Sc. in Physics, Chalmers University of Technology, Sweden: 2001 - B.Sc. (Physics), Chulalongkorn University: 1998	Roche, B., Roulleau, P., Jullien, T., Jompol, Y., Farrer, I., Ritchie, D.A., Glattli, D.C. Harvesting dissipated energy with a mesoscopic ratchet (2015) Nature Communications, 6, art. no. 6738

10. Study Site Location

Mahidol University, Salaya Campus, Phutthamonthon District, Nakhon Pathom Province

11. External Factors and/or Development Considered in Program Planning

11.1 Economic Circumstances / Development

The curriculum is revised according to the 12th National Economic and Social Development Plan (2017-2021), especially the policies to pull the country out of the middle-income trap and to promote Thailand 4.0. In order to cope with the challenges of economic and social development dynamic, natural resource depletion, and environment crises, building human capital for science, technology, and innovation readiness is a key strategy. Consequently, the curriculum is planned to produce brilliant and skillful students in both theory and applications. Students will have a chance to study in various fields of materials and allow to widely integrate basic knowledges to create innovation in the field of materials science and nanoengineering. Students will use these chances to develop a skill to communicate internationally including to assist and improve the global compatibility of society and country.

Materials science technology have high impact in the society and directly influenced the development of the global economy. Most of materials are related to the



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development in several fields including nanotechnology, information technology, biotechnology construction, space technology, agricultural technology and so on. In order to accommodate such a change, the development of human resource in materials science and engineering is essential. The integration knowledge in materials science and engineering is required. The students will be able to use materials science and nanoengineering knowledge to boost up the development of this country. Furthermore, students will learn how to use English as an international language for everyday life communication, the program will ensure their internationalization.

11.2 Social and Cultural Circumstances / Development

Transferring of current society into a society of knowledge is a very crucial attempt for making a value-added attitude to people of this country. Furthermore, it helps to establish a mutual understanding of utilization of resource in a full capacity. With this change, the sustainability will be initiated and stabilized and finally this country will be prosperous by knowledgeable and high moral people. The objective of our society is to provide a proper education to people and make them realize the importance of academic ethic, respect their own culture, and believe that all their actions might influence the progression of the country. Materials Science and Nanoengineering Program will take part in this scheme by producing skillful students with material process that is benefit the surrounding and society. These will support and promote the overall development of culture and country into the right direction.

12. Impacts of Factors in 11.1 and 11.2 on Curriculum Development and Related Institutional Missions

12.1 Curriculum Development

To develop the revised curriculum effectively, changes and developments in science, technology, and the socio-economic structure must be taken into consideration. Consequently, the students must be prepared with 21st century knowledge and skills in order to be ready for change, transformation, and adaptation. The curriculum is developed under the guidelines of Thai Quality Framework (TQF), focusing on the learning



areas including ethics and moral, knowledge, cognitive skills, interpersonal skills and responsibility, and numerical analysis, communication, and information technology skills, and the guidelines of AUN-QA, focusing on the expected learning outcome. Materials science and nanoengineering is one of the most important topics in science and technology for the development of garment, construction, automobile, electronic, medical and biomedical, food and agriculture. Therefore, the program is found to develop the highly skilled people in the field of materials science and nanoengineering with good social and academic ethics. Students who graduated from this program will produce the innovation for material industries.

12.2 Related Institutional Missions

The mission of Mahidol University is to excel in health, sciences, arts, and innovation with integrity for the betterment of Thai society and the benefit of mankind. Thus, the revised curriculum aims to provide outcome-based education, in order to produce graduates who can develop their potential of using undergraduates' knowledge and skills. The graduates are expected to acquire MU graduate attributes; i.e., T-shape breadth and depth, globally talented, socially contributing and entrepreneurially minded (see Appendix 2 page 94). Materials science and nanoengineering program is prepared to meet the challenges of living and working in a diverse and globalized world. Students are expected to acquire, utilize and apply their knowledge in professional career and for the benefit of humankind.

13. Relations to Other Programs Offered by Other Faculties / Departments in the Institution

13.1 Course(s) offered by other faculties/departments

The General Education subjects are offered by other departments in Faculty of Science and other faculties including

credits (theory – lab/practice – self-study)

วทวน ๑๐๑	การคิดสร้างสรรค์และนวัตกรรม	2 (2-0-4)
SCIN 101	Creative Thinking and Innovation	



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สวศท ๑๐๕	บูรณาการสุขภาพและสิ่งแวดล้อม	3 (3-0-6)
ENGE 105	Integrating Health and Environment	
วทศร ๑๐๓	เทคโนโลยีสารสนเทศในชีวิตประจำวัน	3 (3-0-6)
SCID 103	Information Technology in Daily Life	
วทศ ๑๕๒	นิทัศน์ทางวิทยาศาสตร์ธรรมชาติ	3 (1-4-4)
SCBE 152	Natural Science Illustration	
วทศ ๒๕๕	สุนทรียศาสตร์ของกลิ่นและรส	3 (3-0-6)
SCBE 255	Aesthetics of Fragrance and flavor	
วจปส ๑๐๑	ประชากรและการพัฒนา	2 (2-0-4)
PRPR 101	Population and Development	
วจปส ๑๐๒	ภูมิภาคศึกษา	2 (2-0-4)
PRPR 102	Regional Studies	
credits (theory – lab/practice – self-study)		
ศศภอ ๑๘๐	ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ ๑	2 (2-0-4)
LAEN 180	English for Academic Purpose I	
ศศภอ ๑๘๑	ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ ๒	2 (2-0-4)
LAEN 181	English for Academic Purpose II	
ศศภอ ๒๘๒	พหุภาษาและพหุวัฒนธรรม	2 (2-0-4)
LAEN 282	Multilingualism and Multiculturalism	
Core courses offered by Faculty of Engineering		
วศอก ๑๙๕	ปฏิบัติการวิศวกรรมพื้นฐาน	3 (2-2-5)
EGIE 195	Basic Engineering Workshops	
วศอก ๒๙๕	กลศาสตร์สำหรับวิศวกรรมวัสดุ	3 (3-0-6)
EGIE 295	Mechanics for Materials Engineering	



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13.2 Course(s) offer for other Faculties/Departments

The **General Education subjects** are offered to other departments in Faculty of Science and other faculties including

		credits (theory – lab/practice – self-study)
วทวน ๑๓๐	วิทยาศาสตร์และเทคโนโลยีด้านพลังงาน	3 (3-0-6)
SCME 130	Energy Sciences and Technology	
วทวน ๓๗๒	วิทยาศาสตร์และนวัตกรรม	3 (3-0-6)
SCME 372	Scientific Creativity and Innovation	

13.3 Coordination

The Program Director will coordinate with other relevant programs/faculty under the university regulations.

Section 2 Specific Data of the Program

1. Philosophy, Rationale, and Objectives of the Program

1.1 Program Philosophy

Our primary focus is on educating the learners, as for them to attain academic achievement through learning-centered education, outcome-based education and constructivism. To become a wisdom graduate, learners combine what they have learned so far with the new knowledge, and with experiential learning activities. While the role of a lecturer in the learning process is shift from an information provider to a coach or a facilitator creating challenge-based activities.

1.2 Program Objectives

1.2.1 Program Objectives

To produce graduates who have the characteristics, knowledge and skills as follows:

1. integrate and apply knowledge in materials science, nanoscale science,



technology, and related sciences to address current and future industrial needs.

2. demonstrate technical skills for using instruments, planning and development of projects involved in manufacturing and service industries.

3. have responsibility for society and creative thinking as well as self-development.

4. have leadership, professional ethics, and formulate ideas and products to serve the social needs.

1.2.2 Program–level Learning Outcomes: PLOs

At the end of the program, successful students will be able to:

1. PLO1 Solve industrial problems in the field of materials science and nanoengineering logically by applying interdisciplinary approaches.
2. PLO2 Carry out industrial and academic works relating to materials science and nanoengineering by using appropriate instruments and in accordance with international standard methodology.
3. PLO3 Create an independent project in material science and nanoengineering analyzed from scientific journals and laboratory reports along with laboratory safety skills and professional code of conduct.
4. PLO4 Communicate concepts of material science and nano engineering clearly and purposefully with target audiences in English, in both written and oral forms with appropriate technologies in an organized manner.
5. PLO5 Work independently and coordinate with others to achieve team goals based on roles and responsibilities of a material scientist.



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2. Improvement Plan

Improvement / Modification Plan	Strategy	Evidence / Indicators
1. To revise curriculum continuously according to social and economic changes including labor market demands	1. Develop a new outcome-based curriculum based on stakeholders' inputs 2. Obtain constants feedbacks on the characteristics, knowledge and skills of graduates to improve upon the curriculum	1. TQF 5, TQF 7 2. Summary of stakeholders' input 3. Academic meeting report, Employers' Satisfaction Survey results, Students' Teaching Evaluation, and a summary of focus group research with students, parents, and alumni with satisfaction over 3.0 out of 5.0
2. To ensure the quality of teaching and learning activities	1. Enhance a faculty's teaching techniques to promote practical learning through faculty trainings and seminars 2. Monitor and improve upon a faculty's teaching performance 3. Emphasize student's demonstration of ideas, logical reasoning, and problem-solving through interactive lectures, laboratory, individual and group	1. Faculty's training needs survey, and a summary of new teaching techniques deployment 2. Teaching evaluation records with continuous improvement goal



Improvement / Modification Plan	Strategy	Evidence / Indicators
	discussions and assignments and active research projects.	
3. To improve students' soft skills	1. Encourage students' participation in extra-curricular activities through student clubs and academic activities organized by external organizations	1. Activity transcript, certifications and awards

Section 3 Educational Management System, Program Implementation, and Structure

1. Educational Management System

1.1 System

Semester system

1.2 Summer Sessions

According to Mahidol University Regulations on Diploma and Undergraduate Studies of the Year B.E. 2552-2560 and SC's Announcement of the Year B.E. 2553, the summer session is not compulsory session. For Faculty of Science, each course offered in the summer session must have at least 15 failing students.

1.3 Credit Equivalence Ratio (In Reference to Semester System)

None



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2. Program Implementation

2.1 Academic Calendar

In regular management, the offered courses are scheduled during normal working hours (08:30 a.m. – 04:30 p.m.) on weekday (Monday – Friday). However, teaching and learning outside of normal working hour are possible with appropriate management.

Semester: 1st Semester : August-December

2nd Semester : January-May

Academic calendar is subjected to change in process of approval by the University Council.

2.2 Admission Requirements

Mahidol Admission Requirements for Plan A and Plan B

1. High school graduates or equivalent certificate in the science and mathematics program and meet the requirements according to the rules and regulations in the student selection methods of the Faculty of Science, Mahidol University.
2. No physical impairment and mental health problems that could affect the studying

University of Technology Sydney for Plan B

B.Sc. student in Materials Science and Nanoengineering who would like to study at the University of Technology Sydney to develop learning experience in the field of Materials Science and Nanoengineering in a multicultural-international environment during the 2nd – 3rd years of study has to meet the following criteria:

1. A candidate must finish the first year of BSc. Program in Materials Science and Nanoengineering (International Program) with GPA higher than 2.5
2. A candidate must pass one of the following English Proficiency Test: IELTS 6.5 overall with a writing score of 6.0, or TOEFL (internet base) 79-93 overall with a writing score of 21, or AE5 Pass, or PTE 58-64, or CAE 176-184
3. Additional requirements complied with MOU between Faculty of Science, Mahidol University and University of Technology Sydney



2.3 Limitations for Certain Groups of Newly Enrolled Students/ 2.4 Strategies to Resolve Students' Limitations in 2.3

Limitations of Newly Enrolled Students	Strategies to Resolve Students' Limitations
1. English and math skills	1. Students with limited English and/or math skills are required to attend the provided basic science, mathematics and English courses
2. New environmental adaptation of students in university	2. Students are encouraged to participate in extra-curricular activities through student clubs

2.5 A Five-year Plan for Admission and Graduation

Academic Year	2019	2020	2021	2022	2023
First-year student	25	25	25	25	25
Second-year student	-	25	25	25	25
Third-year student	-	-	25	25	25
Fourth-year student	-	-	-	25	25
Cumulative number	25	50	75	100	100
Number of expected graduates	-	-	-	25	25

2.6 Budget Plan

Investment

2.6.1 Breakeven/worthiness

Plan A

- Income per person/throughout the program: 550,000 baht
- Expenses per person/ throughout the program: 512,221.43 baht
- The smallest number of students above the breakeven point: 7
- The expected number of students: 30



Plan B

- Income per person/throughout the program: 2,033,366.40 baht
- Expenses per person/ throughout the program: 1,814,766.40 baht
- The smallest number of students above the breakeven point: 1
- The expected number of students: 10

2.6.2 Budget and costs for producing graduates (baht per year)

1) Costs in producing graduates

Plan A

No.	Costs	Baht per Year
1	Costs on personnel	1,868,000
2	Hire, supplies and materials	21,450
3	Public utilities	115,500
4	Depreciation	824,100
5	Subsidy (/student)	108,000

Plan B

No.	Costs	Baht per Year
1	Subsidy (/student)	52,400

Note: Costs on personnel, hire, supplies and materials, public utilities and depreciation are included in Plan A

2) Income from tuition fee and others

Plan A

No.	Incomes	Bath/year/student
1	Tuition fee / course credits	270,000
2	Outsource fund or income that supports the program	280,000
3	Others	



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Plan B

No.	Incomes	Bath/year/student
1	Tuition fee / course credits MU	1920,866
2	Tuition fee / course credits AU	1,762,366
3	Outsource fund or income that supports the program	140,000
4	Others	

2.7 Academic System

Plan A	Plan B	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	In Class
<input type="checkbox"/>	<input type="checkbox"/>	Distance Learning Mainly Through Printed Materials
<input type="checkbox"/>	<input type="checkbox"/>	Distance Learning Mainly Through Broadcast Media
<input type="checkbox"/>	<input type="checkbox"/>	Distance Learning Mainly Through Electronic Media (E-learning)
<input type="checkbox"/>	<input type="checkbox"/>	Distance Learning Through the Internet
<input type="checkbox"/>	<input type="checkbox"/>	Others (Please Specify)

2.8 Credit Transfer and Cross-institutional Enrollment (If any)

According to Mahidol University Regulations on Diploma and Undergraduate Studies of the Year B.E. 2552-2560

3. Program and Faculty Members

3.1 Program

3.1.1 Total Credits Required

Plan A - no less than 132 credits of courses taken while studying at Mahidol University.

Plan B - no less than 83 credits of courses taken while studying at Mahidol University, and no less than 96 credits of courses taken while studying at University of Technology Sydney (equivalent to 53 Mahidol credits)



3.1.2 Program Structure complies with the Standard of Undergraduate Programs of Study B.E. 2558 announced by the Ministry of Education.

Course Category	Standard guideline of the Ministry of Education for the undergraduate level of education of the year B.E. 2558. (4-year program) (credits)	Plan A (credits)	Plan B (credits)
1. General Education Courses 1. Social Sciences and Humanities 2. Languages 3. Science and Mathematics	no less than 30	30 [#]	30 [#]
2. Core Courses 1. Science and Mathematics 2. Major Required Courses in materials science and nanoengineering 3. Major Elective Courses in materials science and nanoengineering	no less than 72	97 30 50 17	53+90* 18+30* 35+30* 0+30*
3. Free Elective Courses	no less than 6	6	0+6*
Total Credits	no less than 120	133	83+96*

*credits while studying at Mahidol University + credits while studying at University of Technology Sydney

Students have the choice of completing the General Education courses provided by other programs/departments/faculties to fulfill the credit requirement.



3.1.3 Courses of the Program

Courses are listed respectively in the categories: general education courses, core courses and free electives, each with course codes alphabetically listed.

In each course code, credit numbers are shown before the parentheses, and teaching hours and/or practicing hours and self-study hours are shown in the parentheses.

Course codes of the Bachelor of Science Program in Materials Science and Nanoengineering (International program) at Faculty of Science, Mahidol University, consist of 7 characters: 4 letters and 3 numbers.

a. Meaning of the 4 letters:

- **The first 2 letters** are the initials of the faculty/institution in charge, namely

- วท – SC indicates Faculty of Science
- วจ – PR indicates Institute for Population and Social research
- สว – EN indicates Faculty of Environment and Resource Studies
- ศศ – LA indicates Faculty of Liberal Arts
- วศ – EG indicates Faculty of Engineering

- **The last 2 letters** are the initials of the department/project in charge of teaching management.

faculty/institution	abbreviation	full name
Faculty of Science	คณ – MA	Mathematics
	คม – CH	Chemistry
	ทส – BE	Bioresources & Environmental Biology
	ฟส – PY	Physics
	คร – ID	Multidisciplinary
	วน – ME	Materials science and nanoengineering
	ชพ – BM	Biomedical Science
	วณ – IN	Bioinnovation



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Faculty of Environment and Resource Studies	ศท – GE	General education
Faculty of Liberal Arts	ภอ – EN	English
Institute for Population and Social research	ปส – PR	Population and social research
Faculty of Engineering	อก – IE	Industrial engineering

b. The 3 digits after the course initials

- **The first digit** indicates the year of study.

- **The second digit** indicates the field of subject.

0 indicates course related to materials science

1 indicates course related to mathematics and computer

2 indicates course related to chemistry

3 indicates course related to physics

4 indicates course related to biology and medical science

5 indicates course related to engineering

6 indicates course related to nanotechnology and nanoengineering

7 indicates course related to industries and businesses

8 indicates course related to laboratory, internship, seminar and project

9 indicates course related to other fields

- **The last digit** indicates the order of the course offered in each course category to avoid repetition.

Courses in Bachelor of Science Program in Materials Science and Nanoengineering

3.1.3.1 General Education 30 Credits

1. Science and Mathematics (20 credits)

credit (theory – lab/practice – self-study)

วทวน ๑๐๑ การคิดสร้างสรรค์และนวัตกรรม 2 (2-0-4)

SCIN 101 Creative Thinking and Innovation

วทวน ๑๓๐ วิทยาศาสตร์และเทคโนโลยีด้านพลังงาน 3 (3-0-6)



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SCME 130	Energy Sciences and Technology	
สวศท ๑๐๕	บูรณาการสุขภาพและสิ่งแวดล้อม	3 (3-0-6)
ENGE 105	Integrating Health and Environment	
วทศร ๑๐๓	เทคโนโลยีสารสนเทศในชีวิตประจำวัน	3 (3-0-6)
SCID 103	Information Technology in Daily Life	
วททส ๑๕๒	นิทัศน์ทางวิทยาศาสตร์ธรรมชาติ	3 (1-4-4)
SCBE 152	Natural Science Illustration	
วททส ๒๕๕	สุนทรียศาสตร์ของกลิ่นและรส	3 (3-0-6)
SCBE 255	Aesthetics of Fragrance and flavor	
วทวณ ๓๗๒	วิทยาศาสตร์และนวัตกรรม	3 (3-0-6)
SCME 372	Scientific Creativity and Innovation	

2. Social Sciences and Humanities (4 credits)

วจปส ๑๐๑	ประชากรและการพัฒนา	2 (2-0-4)
PRPR 101	Population and Development	
วจปส ๑๐๒	ภูมิภาคศึกษา	2 (2-0-4)
PRPR 102	Regional Studies	

3. Language (6 credits)

ศศภอ ๑๘๐	ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ ๑	2 (2-0-4)
LAEN 180	English for Academic Purpose I	
ศศภอ ๑๘๑	ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ ๒	2 (2-0-4)
LAEN 181	English for Academic Purpose II	
ศศภอ ๒๘๒	พหุภาษาและพหุวัฒนธรรม	2 (2-0-4)
LAEN 282	Multilingualism and Multiculturalism	

Note: Students have the choice of completing the General Education courses provided by other programs/departments/faculties to fulfill the credit requirement under the consent of advisor, the Program Director or Curriculum Committee in accordance with Mahidol University's regulations.



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3.1.3.2 Specific Courses 96 Credits

1. Science and Mathematics (30 credits)

credit (theory – lab/practice – self-study)

วทคณ ๑๗๔	แคลคูลัสและระบบสมการเชิงอนุพันธ์สามัญ	3 (3-0-6)
SCMA 174	Calculus and Systems of Ordinary Differential Equations	
วทคณ ๑๖๑	เคมีทั่วไป	3 (3-0-6)
SCCH 161	General Chemistry	
วทคณ ๑๘๘	ปฏิบัติการเคมี	1 (0-3-1)
SCCH 189	Chemistry Laboratory	
วทฟส ๑๘๐	ฟิสิกส์ทั่วไป	3 (3-0-6)
SCPY 180	General Physics	
วทฟส ๑๑๑	ปฏิบัติการฟิสิกส์ขั้นพื้นฐาน	1 (0-3-1)
SCPY 111	Basic Physics Laboratory	
วททส ๑๐๑	ชีววิทยาทั่วไป ๑	3 (3-0-6)
SCBE 101	General Biology 1	
วททส ๑๐๒	ปฏิบัติการชีววิทยาทั่วไป ๑	1 (0-3-1)
SCBE 102	General Biology Laboratory 1	
วทชพ ๑๒๑	ชีววิทยาระดับเซลล์และโมเลกุล	2 (2-0-4)
SCBM 121	Cell and Molecular Biology	
วทคณ ๒๕๙	พีชคณิตเชิงเส้น	3 (3-0-6)
SCMA 259	Linear Algebra	
วทวณ ๒๑๑	การโปรแกรมคอมพิวเตอร์และการจำลอง	3 (3-0-6)
SCME 211	Computer Programing and Simulation	
วทวณ ๒๒๒	เคมีเชิงฟิสิกส์และอุณหพลศาสตร์	3 (3-0-6)
SCME 222	Physical Chemistry and Thermodynamics	
วทวณ ๒๓๑	โมเดิร์นฟิสิกส์และกลศาสตร์ควอนตัม	3 (3-0-6)
SCME 231	Modern Physics and Quantum Mechanics	
วทวณ ๓๐๕	ทักษะสำคัญสำหรับการวิจัยทางวิทยาศาสตร์	1 (1-0-2)
SCIN 305	Essential Skills for Scientific Research	



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2. Major required core course in materials science and nanoengineering (49 credits)
credit (theory – lab/practice – self-study)

วศอก ๑๙๕	ปฏิบัติการวิศวกรรมพื้นฐาน	3 (2-2-5)
EGIE 195	Basic Engineering Workshops	
วศอก ๒๙๕	กลศาสตร์สำหรับวิศวกรรมวัสดุ	3 (3-0-6)
EGIE 295	Mechanics for Materials Engineering	
วทวน ๑๐๑	หลักการขั้นแนะนำทางวัสดุศาสตร์	3 (3-0-6)
SCME 101	Introduction to Materials	
วทวน ๒๐๒	หลักการเบื้องต้นของเซรามิก	3 (3-0-6)
SCME 202	Basic Principle of Ceramics	
วทวน ๒๐๓	กายภาพของโลหะ	3 (3-0-6)
SCME 203	Physical Metallurgy	
วทวน ๒๖๓	นาโนเทคโนโลยีทางชีวภาพ	3 (3-0-6)
SCME 263	Nanobiotechnology	
วทวน ๒๖๔	วัสดุนาโนและการประยุกต์	3 (3-0-6)
SCME 264	Nanomaterials and Applications	
วทวน ๒๘๒	โครงการนวัตกรรมวัสดุ ๑	1 (0-3-1)
SCME 282	Materials Innovation Project I	
วทวน ๒๘๓	โครงการนวัตกรรมวัสดุ ๒	1 (0-3-1)
SCME 283	Materials Innovation Project II	
วทวน ๓๐๑	การใช้เครื่องมือสำหรับวัสดุศาสตร์และวิศวกรรมนาโน	3 (3-0-6)
SCME 301	Instrumental Methods for Materials Science and Nano Engineering	
วทวน ๓๒๑	วิทยาศาสตร์พอลิเมอร์และการขึ้นรูป	3 (3-0-6)
SCME 321	Principle of Polymer Science and Processing	
วทวน ๓๗๓	วัสดุศาสตร์และวิศวกรรมนาโนในระบบโรงงานอุตสาหกรรม	3 (3-0-6)
SCME 373	Materials Science and Nanoengineering in Industrial Process	
วทวน ๓๓๐	ฟิสิกส์สถานะแข็งสำหรับวัสดุศาสตร์	3 (3-0-6)
SCME 330	Solid State Physics for Materials Science	
วทวน ๓๖๑	สารกึ่งตัวนำและนาโนอิเล็กทรอนิกส์	3 (3-0-6)



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SCME 361	Semiconductors and Nano Electronic	
วทวน ๓๘๑	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์และวิศวกรรมนาโน ๑	1 (0-3-1)
SCME 381	Research Laboratory in Materials Science and Nano Engineering I	
วทวน ๓๘๒	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์และวิศวกรรมนาโน ๒	1 (0-3-1)
SCME 382	Research Laboratory in Materials Science and Nano Engineering II	
วทวน ๓๘๖	สัมมนาวัสดุศาสตร์และวิศวกรรมนาโน	1 (0-3-1)
SCME 386	Seminar in Materials Science and Nano Engineering	
วทวน ๔๘๖	โครงการวิจัยวัสดุศาสตร์	9 (0-27-9)
SCME 486	Materials Science Research Project	

Note: SCME 486 can be completed in research laboratory both in university and industry

3. Major Elective Courses in materials science and nanoengineering (17 credits)

Divided into 4 subjects which can be chosen in association

Materials and nanoengineering in electronics

วทวน ๒๖๐	กระบวนการทางพื้นผิว	3 (3-0-6)
SCME 260	Surface Process	
วทวน ๒๖๑	เครื่องสแกนนิ่งโพรบและกล้องจุลทรรศน์อิเล็กตรอน	3 (3-0-6)
SCME 261	Scanning Probe and Electron Microscopy	
วทวน ๓๓๒	วัสดุแม่เหล็กและวัสดุอิเล็กทรอนิกส์	3 (3-0-6)
SCME 332	Magnetic and Electronic Materials	
วทวน ๓๓๓	เทคโนโลยีฟิล์มบางและการประดิษฐ์โครงสร้างนาโน	3 (3-0-6)
SCME 333	Thin Film Technology and Nanostructure Fabrication	
วทวน ๓๖๐	ทัศนศาสตร์	3 (3-0-6)
SCME 360	Optics	
วทวน ๓๖๒	นาโนโฟโตนิกส์	3 (3-0-6)
SCME 362	Nanophotonics	
วทวน ๓๘๔	การฝึกวิจัยวัสดุศาสตร์	1 (0-3-1)
SCME 384	Materials Science Research Practice	
วทวน ๓๘๕	การฝึกวิจัยวัสดุศาสตร์และการประยุกต์	1 (0-3-1)



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SCME 385	Materials Science Research Practice and Applications	
วทวน ๔๑๑	การเขียนโปรแกรมสำหรับระบบอัตโนมัติในกระบวนการผลิต	3 (3-0-6)
SCME 411	Programing for automatic system in manufacturing process	
วทวน ๔๓๑	การจำลองโมเลกุล	3 (3-0-6)
SCME 431	Molecular Simulation	
วทวน ๔๕๑	เครื่องมืออิเล็กทรอนิกส์และการเชื่อมต่อกับคอมพิวเตอร์	3 (3-0-6)
SCME 451	Electronic Instrument and Computing Interface	
วทวน ๔๗๑	เทคโนโลยีวัสดุกึ่งตัวนำ	3 (3-0-6)
SCME 471	Semiconductor Technology	
วทวน ๔๗๒	หัวข้อพิเศษทางวัสดุศาสตร์และวิศวกรรมนาโน	3 (3-0-6)
SCME 472	Special Topics in Materials Science and Nanoengineering	
วทวน ๔๘๕	ฝึกงานวัสดุศาสตร์และวิศวกรรมนาโน	9 (0-27-9)
SCME 485	Internship in Materials Science and Nanoengineering	
<u>Materials and nanoengineering in biomedical</u>		
วทวน ๓๔๑	ความเป็นพิษของวัสดุ	3 (3-0-6)
SCME 341	Toxicology of Materials	
วทวน ๓๔๒	นาโนเทคโนโลยีในการนำส่งยา	3 (3-0-6)
SCME 342	Nanotechnology in Drug Delivery	
วทวน ๔๓๒	วัสดุที่มีความอ่อนตัวและการประยุกต์ใช้ทางชีวภาพ	3 (3-0-6)
SCME 432	Soft Materials and Bioapplications	
วทวน ๔๔๑	ชีววัสดุทางการแพทย์และอุปกรณ์สำหรับซ่อมแซมร่างกาย	3 (3-0-6)
SCME 441	Biomedical Materials and Devices for Human Body Repair	
วทวน ๔๔๒	หัวข้อพิเศษทางวัสดุชีวการแพทย์	3 (3-0-6)
SCME 442	Special Topics in Biomedical Materials	
<u>Materials and nanoengineering in industrial chemistry</u>		
วทวน ๓๐๔	ความปลอดภัยและการจัดการของเสีย	3 (3-0-6)
SCME 304	Safety and Waste Management	
วทวน ๓๒๔	การเสื่อมของวัสดุ	3 (3-0-6)
SCME 324	Degradation of Materials	
วทวน ๓๓๕	วัสดุอินทรีย์	3 (3-0-6)



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SCME 335	Inorganic Materials	
วทวน ๓๖๔	นาโนเทคโนโลยีเชิงโมเลกุล	3 (3-0-6)
SCME 364	Molecular Nanotechnology	
วทวน ๔๐๑	วัสดุเชิงประกอบ	2 (2-0-4)
SCME 401	Composite Materials	
วทวน ๔๐๒	การแปรรูปพลาสติกและเทคโนโลยียาง	3 (3-0-6)
SCME 402	Polymer processing and rubber technology	
วทวน ๔๒๑	เคมีอุตสาหกรรมสำหรับวัสดุศาสตร์	3 (3-0-6)
SCME 421	Industrial Chemistry for Materials Science	
วทวน ๔๒๒	วัสดุอินทรีย์และการขึ้นรูป	3 (3-0-6)
SCME 422	Organic Materials and Processing	
วทวน ๔๓๓	ปัญหาพิเศษทางวัสดุศาสตร์และวิศวกรรมนาโน	3 (3-0-6)
SCME 433	Special Problems in Materials Science and Nanoengineering	
วทวน ๔๖๑	นาโนเทคโนโลยีในวิทยาศาสตร์พอลิเมอร์	3 (3-0-6)
SCME 461	Nanotechnology in Polymer Sciences	
<i>Materials and nanoengineering in business</i>		
วทวน ๓๗๕	หลักสูตรกิจพื้นฐานสำหรับนักวิทยาศาสตร์ผู้ประกอบการ	3 (3-0-6)
SCME 375	Business Concepts for Science Entrepreneurs	

3.1.3.3 Free elective courses 6 credits

Students can select elective courses provided by the program and other elective courses provided by Mahidol University. In the latter case, the selected elective courses must be in agreement with Faculty of Science, Mahidol University.

3.1.3.4 University of Technology Sydney Courses

(Bachelor of Science (Nanotechnology))

Second and third-year students in Plan B program study the following courses at University of Technology Sydney



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Mahidol University		University of Technology Sydney	
Course code	Course name	Course code	Course name
SCMA 192	Calculus and Systems of Ordinary Differential Equations	33130	*Mathematical Modeling I
		33230	*Mathematical Modeling II
SCMA 259	Linear Algebra	33360	*Mathematics for Physical Science
SCME 231	Modern Physics and Quantum Mechanics	68201	*Physics in Action
SCME 330	Solid-State Physics for Materials Science	68606	*Solid-state Science and Nanodevices
SCME 361	Semiconductor and Nanoelectronics		
SCME 222	Physical Chemistry and Thermodynamics	65307	*Physical Chemistry I
SCME 211	Computer Programming and Simulation	68416	*Computational Physics
SCME 263	Nanobiotechnology	91140	*Bionanotechnology
SCME 264	Nanomaterials and Applications	68075	Nanomaterials
	Free elective 6 cp	65212	*Chemistry 2
SCME 130	Energy Science & Technology	68412	Energy Science & Technology
SCME 360	Optics	68206	Optics
SCME 362	Nanophotonics	68513	Nanophotonics
SCME 261	Scanning Probe and Electron Microscopy	68320	Scanning Probe and Electron Microscopy
SCME 451	Applied Electronics and Interfacing	68316	Applied Electronics and Interfacing



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Mahidol University		University of Technology Sydney	
Course code	Course name	Course code	Course name
SCME 364	Molecular Nanotechnology	67509	Molecular Nanotechnology
SCME 260	Surface Processes	optional subject	Surface Processes
SCME 472	Quantum Physics	68413	Quantum Physics

Note:

* This course is taught as modular courses

6 credits at University of Technology Sydney, Australia is equal to averages of 4-6 hours in class per week

hpw = hour per week



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3.1.4 Study Plan

Plan A

Year 1 Semester 1

Code	Name	Credits (Theory-Laboratory -self study)
วททส ๑๐๑ SCBE 101	ชีววิทยาทั่วไป ๑ General Biology 1	3 (3-0-6)
วททส ๑๐๒ SCBE 102	ปฏิบัติการชีววิทยาทั่วไป ๑ General Biology Laboratory 1	1 (0-3-1)
วจปส ๑๐๒ PRPR 102	ภูมิภาคศึกษา Regional Studies	2 (2-0-4)
วทคร ๑๐๓ SCID 103	เทคโนโลยีสารสนเทศในชีวิตประจำวัน Information Technology in Daily Life	3 (3-0-6)
วทฟส ๑๑๑ SCPY 111	ปฏิบัติการฟิสิกส์ขั้นพื้นฐาน Basic Physics Laboratory	1 (0-3-1)
วทคม ๑๖๑ SCCH 161	เคมีทั่วไป General Chemistry	3 (3-0-6)
วทคณ ๑๗๔ SCMA 174	แคลคูลัสและระบบสมการเชิงอนุพันธ์สามัญ Calculus and System of Ordinary Differential Equations	3 (3-0-6)
ศศกอ ๑๘๐ LAEN 180	ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ ๑ English for Academic Purpose I	2 (2-0-4)
วทฟส ๑๘๐ SCPY 180	ฟิสิกส์ทั่วไป General Physics	3 (3-0-6)
วทคม ๑๘๙ SCCH 189	ปฏิบัติการเคมี Chemistry Laboratory	1 (0-3-1)
Total		22



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Year 1 Semester 2

Code	Name	Credits (Theory-Laboratory -self study)
วจปส ๑๐๑ PRPR 101	ประชากรและการพัฒนา Population and Development	2 (2-0-4)
วทวน ๑๐๑ SCME 101	หลักการขั้นแนะนำทางวัสดุศาสตร์ Introduction to Materials	3 (3-0-6)
สวศท ๑๐๕ ENGE 105	บูรณาการสุขภาพและสิ่งแวดล้อม Integrated Health and Environment	3 (3-0-6)
วทชพ ๑๒๑ SCBM 121	ชีววิทยาระดับเซลล์และโมเลกุล Cell and Molecular Biology	2 (2-0-4)
ศศกอ ๑๘๑ LAEN 181	ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ ๒ English for Academic Purpose II	2 (2-0-4)
วศอก ๑๙๕ EGIE 195	ปฏิบัติการวิศวกรรมพื้นฐาน Basic Engineering Workshops	3 (2-2-5)
ศศกอ ๒๘๒ LAEN 282	พหุภาษาและพหุวัฒนธรรม Multilingualism and Multiculturalism	2 (2-0-4)
วทนว ๓๐๕ SCIN 305	ทักษะสำคัญสำหรับการวิจัยทางวิทยาศาสตร์ Essential Skills for Scientific Research	1 (1-0-2)
วทวน ๓๗๒ SCME 372	วิทยาศาสตร์และนวัตกรรม Scientific Creativity and Innovation	3 (3-0-6)
Total		21



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Year 2 Semester 1

Code	Name	Credits (Theory-Laboratory -self study)
วทวน ๑๐๑ SCIN 101	การคิดสร้างสรรค์และนวัตกรรม Creative Thinking and Innovation	2 (2-0-4)
วทวน ๑๓๐ SCME 130	วิทยาศาสตร์และเทคโนโลยีด้านพลังงาน Energy Sciences and Technology	3 (3-0-6)
วทคณ ๒๕๙ SCMA 259	พีชคณิตเชิงเส้น Linear Algebra	3 (3-0-6)
วทวน ๒๖๓ SCME 263	นาโนเทคโนโลยีทางชีวภาพ Nanobiotechnology	3 (3-0-6)
วทวน ๒๖๔ SCME 264	วัสดุนาโนและการประยุกต์ Nanomaterials and Applications	3 (3-0-6)
วทวน ๒๘๒ SCME 282	โครงการนวัตกรรมวัสดุ ๑ Materials Innovation Project I	1 (0-3-1)
วศอก ๒๙๕ EGIE 295	กลศาสตร์สำหรับวิศวกรวัสดุ Mechanics for Materials Engineers	3 (3-0-6)
Total		18



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Year 2 Semester 2

Code	Name	Credits (Theory-Laboratory -self study)
วททส ๑๕๒ SCBE 152	นิทัศน์ทางวิทยาศาสตร์ธรรมชาติ Natural Science Illustration	3 (1-4-4)
วทวน ๒๐๒ SCME 202	หลักการเบื้องต้นของเซรามิก Basic Principle of Ceramics	3 (3-0-6)
วทวน ๒๐๓ SCME 203	กายภาพของโลหะ Physical Metallurgy	3 (3-0-6)
วทวน ๒๑๑ SCME 211	การโปรแกรมคอมพิวเตอร์และการจำลอง Computer Programing and Simulation	3 (3-0-6)
วทวน ๒๒๒ SCME 222	เคมีเชิงฟิสิกส์และอุณหพลศาสตร์ Physical Chemistry and Thermodynamics	3 (3-0-6)
วทวน ๒๓๑ SCME 231	โมเดิร์นฟิสิกส์และกลศาสตร์ควอนตัม Modern Physics and Quantum Mechanics	3 (3-0-6)
วททส ๒๕๕ SCBE 255	สุนทรียศาสตร์ของกลิ่นและรส Aesthetics of Fragrance and Flavor	3 (3-0-6)
วทวน ๒๘๓ SCME 283	โครงการนวัตกรรมวัสดุ ๒ Materials Innovation Project II	1 (0-3-1)
Total		22



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Code	Name	Credits (Theory-Laboratory -self study)
วทวน ๓๐๑ SCME 301	การใช้เครื่องมือสำหรับวัสดุศาสตร์และวิศวกรรมนาโน Instrumental Methods for Materials Science and Nano Engineering	3 (3-0-6)
วทวน ๓๒๑ SCME 321	วิทยาศาสตร์พอลิเมอร์และการขึ้นรูป Principle of Polymer Science and Processing	3 (3-0-6)
วทวน ๓๓๐ SCME 330	ฟิสิกส์สถานะแข็งสำหรับวัสดุศาสตร์ Solid-State Physics for Materials Science	3 (3-0-6)
วทวน ๓๘๑ SCME 381	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์และวิศวกรรมนาโน ๑ Research Laboratory in Materials Science and Nano Engineering I	1 (0-3-1)
	วิชาเลือกในกลุ่มวิชาวัสดุศาสตร์และวิศวกรรมนาโน Major Elective	4
	วิชาเลือกเสรี Free Elective	3
	Total	17



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Code	Name	Credits (Theory-Laboratory -self study)
วทวน ๓๖๑ SCME 361	สารกึ่งตัวนำและนาโนอิเล็กทรอนิกส์ Semiconductor and Nano Electronics	3 (3-0-6)
วทวน ๓๗๓ SCME 373	วัสดุศาสตร์และวิศวกรรมนาโนในกระบวนการอุตสาหกรรม Materials Science and Nano Engineering in Industrial Process	3 (3-0-6)
วทวน ๓๘๒ SCME 382	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์และวิศวกรรมนาโน ๒ Research Laboratory in Materials Science and Nano Engineering II	1 (0-3-1)
วทวน ๓๘๖ SCME 386	สัมมนาวัสดุศาสตร์และวิศวกรรมนาโน Seminar in Materials Science and Nano Engineering	1 (0-3-1)
	วิชาเลือกในกลุ่มวิชาวัสดุศาสตร์และวิศวกรรมนาโน Major Elective	4
	วิชาเลือกเสรี Free Elective	3
	Total	15



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Year 4 Semester 1

Code	Name	Credits (Theory-Laboratory -self study)
วทวน ๔๘๖ SCME 486	โครงการวิจัยวัสดุศาสตร์ Materials Science Research Project	9 (0-27-9)
Total		9

Year 4 Semester 2

Code	Name	Credits (Theory-Laboratory -self study)
	วิชาเลือกในกลุ่มวิชาวัสดุศาสตร์และวิศวกรรมนาโน Major Elective	9
Total		9



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Plan B

Year 1 Semester 1 (at Mahodol University)

Code	Name	Credits (Theory-Laboratory -self study)
วททส ๑๐๑ SCBE 101	ชีววิทยาทั่วไป ๑ General Biology 1	3 (3-0-6)
วททส ๑๐๒ SCBE 102	ปฏิบัติการชีววิทยาทั่วไป ๑ General Biology Laboratory 1	1 (0-3-1)
วจปส ๑๐๒ PRPR 102	ภูมิภาคศึกษา Regional Studies	2 (2-0-4)
วทคร ๑๐๓ SCID 103	เทคโนโลยีสารสนเทศในชีวิตประจำวัน Information Technology in Daily Life	3 (3-0-6)
วทฟส ๑๑๑ SCPY 111	ปฏิบัติการฟิสิกส์ขั้นพื้นฐาน Basic Physics Laboratory	1 (0-3-1)
วทคม ๑๖๑ SCCH 161	เคมีทั่วไป General Chemistry	3 (3-0-6)
วทคณ ๑๗๔ SCMA 174	แคลคูลัสและระบบสมการเชิงอนุพันธ์สามัญ Calculus and System of Ordinary Differential Equations	3 (3-0-6)
ศศกอ ๑๘๐ LAEN 180	ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ ๑ English for Academic Purpose I	2 (2-0-4)
วทฟส ๑๘๐ SCPY 180	ฟิสิกส์ทั่วไป General Physics	3 (3-0-6)
วทคม ๑๘๙ SCCH 189	ปฏิบัติการเคมี Chemistry Laboratory	1 (0-3-1)
Total		22



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Year 1 Semester 2 (at Mahidol University)

Code	Name	Credits (Theory-Laboratory -self study)
วจปส ๑๐๑ PRPR 101	ประชากรและการพัฒนา Population and Development	2 (2-0-4)
วทวน ๑๐๑ SCME 101	หลักการขั้นแนะนำทางวัสดุศาสตร์ Introduction to Materials	3 (3-0-6)
สวศท ๑๐๕ ENGE 105	บูรณาการสุขภาพและสิ่งแวดล้อม Integrated Health and Environment	3 (3-0-6)
วทชพ ๑๒๑ SCBM 121	ชีววิทยาระดับเซลล์และโมเลกุล Cell and Molecular Biology	2 (2-0-4)
ศศกอ ๑๘๑ LAEN 181	ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ ๒ English for Academic Purpose II	2 (2-0-4)
วศอก ๑๙๕ EGIE 195	ปฏิบัติการวิศวกรรมพื้นฐาน Basic Engineering Workshops	3 (2-2-5)
ศศกอ ๒๘๒ LAEN 282	พหุภาษาและพหุวัฒนธรรม Multilingualism and Multiculturalism	2 (2-0-4)
วทนว ๓๐๕ SCIN 305	ทักษะสำคัญสำหรับการวิจัยทางวิทยาศาสตร์ Essential Skills for Scientific Research	1 (1-0-2)
วทวน ๓๗๒ SCME 372	วิทยาศาสตร์และนวัตกรรม Scientific Creativity and Innovation	3 (3-0-6)
Total		21



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Year 2 Spring semester (Semester 1 at UTS)

Code	Module Title	Credits
33130	Mathematical Modeling I	6
68201	Physics in Action	6
65212	Chemistry 2	6
33230	Mathematical Modeling II	6
	Total	24

Year 2 Autumn Semester (Semester 2 at UTS)

Code	Module Title	Credits
33360	Mathematics for Physical Science	6
65307	Physical Chemistry I	6
68412	Energy Science & Technology	6
68075	Nanomaterials	6
	Total	24



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Year 3 Spring Semester (Semester 1 at UTS)

Code	Module Title	Credits
91140 or 68320	Bionanotechnology or Scanning Probe and Electron Microscopy	6
68513	Nanophotonics	6
68413	Quantum Physics	6
68206	Optics	6
	Total	24

Year 3 Autumn Semester (Semester 2 at UTS)

Code	Module Title	Credits
68316	Applied Electronics and Interfacing	6
67509	Molecular Nanotechnology	6
68606	Solid-state Science and Nanodevices	6
68416	Computational Physics	6
	Total	24



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Year 4 Semester 1 (at Mahidol University)

Code	Name	Credits (Theory-Laboratory -self study)
วทวน ๑๐๑ SCIN 101	การคิดสร้างสรรค์และนวัตกรรม Creative thinking & Innovation	2 (2-0-4)
วทวน ๒๘๒ SCME 282	โครงการนวัตกรรมวัสดุ ๑ Materials Innovation Project I	1 (0-3-1)
วศอก ๒๙๕ EGIE 295	กลศาสตร์สำหรับวิศวกรวัสดุ Mechanics for Materials Engineers	3 (3-0-6)
วทวน ๓๐๑ SCME 301	การใช้เครื่องมือสำหรับวัสดุศาสตร์วิศวกรรมนาโน Instrumental Methods for Materials Science and Nano Engineering	3 (3-0-6)
วทวน ๓๒๑ SCME 321	วิทยาศาสตร์พอลิเมอร์และการขึ้นรูป Principle of Polymer Science and Processing	3 (3-0-6)
วทวน ๓๘๑ SCME 381	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์และวิศวกรรมนาโน ๑ Research Laboratory in Materials Science and Nano Engineering I	1 (0-3-1)
วทวน ๔๘๖ SCME 486	โครงการวิจัยด้านวัสดุศาสตร์ Materials Science Research Project	9 (0-27-9)
Total		22



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Year 4 Semester 2 (at Mahidol University)

Code	Name	Credits (Theory-Laboratory -self study)
วทส ๑๕๒ SCBE 152	นิทัศน์ทางวิทยาศาสตร์ธรรมชาติ Natural Science Illustration	3 (1-4-4)
วทวน ๒๐๒ SCME 202	หลักการเบื้องต้นของเซรามิก Basic Principle of Ceramics	3 (3-0-6)
วทวน ๒๐๓ SCME 203	กายภาพของโลหะ Physical Metallurgy	3 (3-0-6)
วทส ๒๕๕ SCBE 255	สุนทรียศาสตร์ของกลิ่นและรส Aesthetics of Fragrance and Flavor	3 (3-0-6)
วทวน ๒๘๓ SCME 283	โครงการนวัตกรรมวัสดุ ๒ Materials Innovation Project II	1 (0-3-1)
วทวน ๓๗๓ SCME 373	วัสดุศาสตร์และวิศวกรรมนาโนในระบบโรงงานอุตสาหกรรม Materials Science and Nano Engineering in Industrial Process	3 (3-0-6)
วทวน ๓๘๒ SCME 382	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์และวิศวกรรมนาโน ๒ Research Laboratory in Materials Science and Nano Engineering II	1 (0-3-1)
วทวน ๓๘๖ SCME 386	สัมมนาวัสดุศาสตร์และวิศวกรรมนาโน Seminar in Materials Science and Nano Engineering	1 (0-3-1)
Total		18

3.1.6 Curriculum Mapping shown in Appendix 4



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3.1.7 Course Description

1. General Education Courses

วททส ๑๕๒ SCBE 152	นิทัศน์ทางวิทยาศาสตร์ธรรมชาติ Natural Science Illustration	3 (1-4-4)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No ทักษะการวาดและถ่ายภาพตัวอย่างเพื่อนำเสนอข้อมูลในการศึกษาวิทยาศาสตร์ธรรมชาติ การใช้ซอฟต์แวร์ตกแต่งภาพ Skills in illustrations and photography of specimens for data presentation in natural science study, picture editing using software	
วทวน ๑๐๑ SCIN 101	การคิดสร้างสรรค์และนวัตกรรม Creative thinking and innovation	2 (2-0-4)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No กระบวนการคิด การคิดสร้างสรรค์ นวัตกรรม การแก้ปัญหา การประยุกต์ใช้การคิดสร้างสรรค์ และนวัตกรรมสำหรับการเรียนรู้ การประยุกต์ใช้การคิดสร้างสรรค์ และนวัตกรรมสำหรับการดำรงชีวิต Thinking process, creative thinking, innovation, problem solving, the applications of creative thinking and innovation to learning, the applications of creative thinking and innovation to living	
วทวน ๓๗๒ SCME 372	วิทยาศาสตร์และนวัตกรรม Scientific Creativity and Innovation	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No แนวคิดนวัตกรรมเบื้องต้น เป้าหมายเชิงนวัตกรรมในแง่ของสังคม วิทยาศาสตร์และเทคโนโลยี ประเภทของนวัตกรรมทั้งสี่ประการ การผสมผสานและการบูรณาการนวัตกรรม จุดเปลี่ยนทางสังคมที่เป็นผลจากนวัตกรรมที่มาจากวิทยาศาสตร์และเทคโนโลยี แนวทางการสร้างนวัตกรรมและการประเมินนวัตกรรม ตัวอย่างนวัตกรรมที่ประสบความสำเร็จภายในประเทศ และตัวอย่างนวัตกรรมระดับโลก นวัตกรรมเชิงเทคโนโลยี หลักแนวคิดเชิงเทคโนโลยีที่เกี่ยวข้องกับนวัตกรรม ตัวอย่างเทคโนโลยีที่เป็นนวัตกรรม	



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	Basic principles of innovation, the aim of innovation in terms of society, science and technology; ten types of innovations, concepts integration and complementary of innovation; turning point of society from scientific innovations, innovation incubation, example of successful innovation in the country and in the world, basic principles of technology, innovations in technology, examples of technological innovation	
วทวน ๑๓๐ SCME 130	วิทยาศาสตร์และเทคโนโลยีด้านพลังงาน Energy Sciences and Technology	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No ฟิสิกส์และเทอร์โมไดนามิกเกี่ยวกับพลังงาน ทฤษฎีที่เกี่ยวข้องกับพลังงานและการนำมาใช้ในทางวิทยาศาสตร์ พื้นฐานความรู้ด้านของไหลและเทอร์โมไดนามิกส์ รวมถึงฟิสิกส์และเทอร์โมไดนามิกส์ของระบบพลังงานและพลังงานหมุนเวียน ความรู้ทางวิทยาศาสตร์เกี่ยวกับพลังงานและเทคโนโลยี ความสามารถในการแก้ปัญหาเกี่ยวกับพลังงาน Physics and thermodynamics of the energy systems; theories related to energy and its applications to scientific work; fluids and thermodynamics studied at the introductory level subjects; physics and thermodynamics underlying the conventional and renewable energy systems; scientific knowledge related to energy and technology; problem-solving ability in practical applications of energy science	
สวศท ๑๐๕ ENGE 105	บูรณาการสุขภาพและสิ่งแวดล้อม Integrating Health and Environment	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No แนวคิดสำหรับ “สุขภาพ” และ “สิ่งแวดล้อม” มิติและระดับของสุขภาพ และปัจจัยที่กำหนดสุขภาพและสิ่งแวดล้อม การปฏิรูประบบสุขภาพการพัฒนาเชิงยุทธศาสตร์สำหรับการเสริมสร้างสุขภาพและสิ่งแวดล้อม การประเมินผลกระทบทางสุขภาพและสิ่งแวดล้อม การวิจัยเชิงบูรณาการเพื่อสุขภาพ ตัวชี้วัดความอยู่ดีมีสุข ระบบสารสนเทศเพื่อเสริมสร้างสุขภาพและสิ่งแวดล้อม นโยบายสุขภาพสาธารณะ กระบวนการเรียนรู้เพื่อพัฒนาคุณภาพชีวิต การ	



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	<p>ดำเนินชีวิตเพื่อสุขภาพและสิ่งแวดล้อม เศรษฐกิจพอเพียง เทคนิคการบูรณาการ สุขภาพและสิ่งแวดล้อมความสัมพันธ์ระหว่างสุขภาพและสิ่งแวดล้อมกับอาชีพ Concepts of “health” and “environment”, dimensions and levels of health and factors determining health and environment; the health system reform; the strategic development of health and environment promotion, healthy public policy, health and environmental impact assessment; integrative research for health and the environment, indicators of well-beings; information system for promoting health and the environment; communication for health and the environment; learning process for developing quality of life, living for health and the environment; self-sufficient economy; techniques for integrating health and the environment, health, environment and occupations</p>	
<p>วทศ ๑๐๓ SCID 103</p>	<p>เทคโนโลยีสารสนเทศในชีวิตประจำวัน Information Technology in Daily Life</p>	<p>3 (3-0-6)</p>
	<p>วิชาบังคับก่อน: ไม่มี Prerequisites: No เทคโนโลยีสารสนเทศและการสื่อสาร ความหมายและส่วนประกอบ ระบบคอมพิวเตอร์ ฮาร์ดแวร์ และซอฟต์แวร์ โปรแกรมประยุกต์ด้านการสื่อสาร โปรแกรมประยุกต์ด้านการจัดการข้อมูล โปรแกรมประยุกต์ด้านการวัดและโปรแกรมประยุกต์ด้านแบบจำลอง การรักษาความปลอดภัย ของคอมพิวเตอร์ การประมวลผลแบบกลุ่มเมฆ จริยธรรมและกฎหมายที่เกี่ยวข้อง Information and communication technologies, meaning and component, the computer system, hardware and software, communication applications, data handling applications; measurement applications and modeling applications; computer security, cloud computing, ethics and laws</p>	
<p>วทศ ๒๕๕ SCBE 255</p>	<p>สุนทรียศาสตร์ของกลิ่นและรส Aesthetics of Fragrance and Flavor</p>	<p>3 (3-0-6)</p>
	<p>วิชาบังคับก่อน: ไม่มี Prerequisites: No</p>	



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	<p>การรับรู้กลิ่นและรส กลิ่นแห่งความตาย รสชาติแห่งรัก กลิ่นและเคมีแห่งกลิ่น สารระเหย กระบวนการกลั่น สุนทรบำบัด น้ำมันหอมระเหย ส่วนผสมและการปรุงสูตร น้ำหอมและสารปรุง แต่งรสชาติ สารเคมีเลียนแบบธรรมชาติและการใช้ประโยชน์</p> <p>Perceptions of fragrance and flavors; smell of death; taste of love; odor and its chemistry; volatile chemicals; distillation process; aromatherapy; essential oils; concoction and formulation; perfume and flavors; natural identical and their applications</p>	
<p>วจปส ๑๐๑ PRPR 101</p>	<p>ประชากรและการพัฒนา Population and Development</p>	<p>2 (2-0-4)</p>
	<p>วิชาบังคับก่อน: ไม่มี Prerequisites: No</p> <p>แนวคิด ทฤษฎีประชากรและการพัฒนา ความสัมพันธ์ระหว่างประชากรและการพัฒนาในมิติทาง ประชากร สังคม และเศรษฐกิจ การพัฒนาทรัพยากรมนุษย์ การศึกษา ความยากจน การย้ายถิ่น และความเป็นเมือง ท้องถิ่น สิ่งแวดล้อมและทรัพยากรธรรมชาติ การมีส่วนร่วมของชุมชน สตรี นิยม การพัฒนาอนุภูมิภาคลุ่มน้ำโขง วิเคราะห์และวิพากษ์ แนวทางการพัฒนา</p> <p>Concepts and theories of population and development, relationships between population and development in terms of population, social and economic aspects, human resource development; education, poverty, migration, urbanization, locality, environment and resources, community participation, feminism; the Greater Mekong Subregion (GMS) development, analyzing and criticizing directions of development</p>	
<p>วจปส ๑๐๒ PRPR 102</p>	<p>ภูมิภาคศึกษา Regional Studies</p>	<p>2 (2-0-4)</p>



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	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p> <p>ทฤษฎีด้านการพัฒนา ทฤษฎีความสัมพันธ์ระหว่างประเทศ วิเคราะห์พัฒนาการและทิศทางการพัฒนาทางเศรษฐกิจและสังคมของประเทศในเอเชีย การรวมกลุ่มทางเศรษฐกิจของภูมิภาค อนุภูมิภาคกลุ่มแม่น้ำโขง ประชาคมอาเซียน เขตการค้าเสรีอาเซียน การวิเคราะห์ผลกระทบที่เกิดขึ้นในด้านเศรษฐกิจ สังคม ประชากรและวัฒนธรรม วิพากษ์ อภิปราย และนำเสนอรายงาน Development theories, international relations theories; an analysis of the economic and social developments and directions of the Asian countries; regional economic integration, Greater Mekong Sub-region (GMS), the ASEAN community, ASEAN-China Free Trade Agreement (FTA); an analysis of economic and socio-cultural impacts; commenting, discussing and presenting reports</p>	
ศศภอ ๑๘๐ LAEN 180	ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ ๑ English for Academic Purpose I	2 (2-0-4)
	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p> <p>คำศัพท์วิชาการ สำนวน ไวยากรณ์ และภาษาที่ใช้บ่อยในบริบทสังคมวิชาการ ทักษะการสื่อสารที่จำเป็นในการสนทนากลุ่มย่อย การจำลองสถานการณ์ที่เกี่ยวข้องกับบริบทมหาวิทยาลัยและวิชาการ การเขียนเชิงวิชาการเบื้องต้นการอ่านและการฟังจากแหล่งข้อมูลต่าง ๆ</p> <p>Vocabularies, expressions, grammar, and contextualized social language; essential communicative skills in small groups; simulations in various university and academic situations; an introduction to academic writing; and reading and listening from various sources</p>	
ศศภอ ๑๘๑ LAEN 181	ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ ๒ English for Academic Purpose II	2 (2-0-4)
	<p>วิชาบังคับก่อน: ศศภอ ๑๘๐ ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ ๑</p> <p>Prerequisites: LAEN 180 English for Academic Purpose I</p> <p>กลยุทธ์ที่สำคัญในทักษะการใช้ภาษาทั้งสี่ การอ่านและการฟังตัวบททางวิชาการ การพูดในเชิงวิชาการและการเขียนระดับเรียงความ รวมทั้งทักษะย่อย คือ ไวยากรณ์ คำศัพท์วิชาการ การเขียนสรุป เน้นภาษาอังกฤษที่ใช้ในระดับอุดมศึกษา และเนื้อหาเกี่ยวกับสังคมโลก</p>	



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	Essential strategies for four language skills: reading and listening from various sources, speaking in academic contexts and essay-writing, including sub-skills i.e., grammar, academic vocabularies, and summary with a focus on academic English and issues related to world societies	
ศศภอ ๒๘๒ LAEN 282	พหุภาษาและพหุวัฒนธรรม Multilingualism and Multiculturalism	2 (2-0-4)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No มโนทัศน์เกี่ยวกับภาษาและวัฒนธรรมต่างๆ รอบโลก ความเป็นนานาชาติ และโลกาภิวัตน์ สาขาลักษณะและความหลากหลายในโลกพหุภาษาและพหุวัฒนธรรม The concepts of languages and cultures around the world; internationalization, and globalization; the universality and diversity in the multilingual and multicultural globe	

2. Core courses

วทคม ๑๖๑ SCCH 161	เคมีทั่วไป General Chemistry	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No โครงสร้างของอะตอม พันธะเคมี แก๊สและทฤษฎีจลน์โมเลกุลของแก๊ส สมดุลระหว่างวัฏภาค สารละลายและคอลลอยด์ อุณหพลศาสตร์เคมี จลนพลศาสตร์เคมี สมดุลของไอออนและไฟฟ้าเคมี Atomic structure; chemical bonding; gases and the kinetic molecular theory of gases; phase equilibria solutions and colloids; chemical thermodynamics; chemical kinetics; ionic equilibria and electrochemistry	
วทคม ๑๘๙ SCCH 189	ปฏิบัติการเคมี Chemistry Laboratory	1 (0-3-1)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No ฝึกเทคนิคทางการทดลองในหัวข้อที่เกี่ยวข้องกับเคมีทั่วไปและเคมีอินทรีย์เบื้องต้น	



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	Practice experimental techniques related to topics in general chemistry and basic organic chemistry	
วทศณ ๑๗๔ SCMA 174	แคลคูลัสและระบบสมการเชิงอนุพันธ์สามัญ Calculus and Systems of Ordinary Differential Equations	3 (3-0-6)
	<p>วิชาบังคับก่อน: ไม่มี Prerequisites: No</p> <p>การทบทวนแคลคูลัสหลักเกณฑ์ลูกโซ่และอนุพันธ์ของฟังก์ชันผกผัน อนุพันธ์ของฟังก์ชันตรีโกณมิติ ฟังก์ชันตรีโกณมิติผกผัน ฟังก์ชันเชิงกำลังและฟังก์ชันลอการิทึม การหาอนุพันธ์โดยปริยายและอัตราสัมพันธ์ การประยุกต์อนุพันธ์ปริยานุพันธ์ ปริพันธ์จำกัดเขตและไม่จำกัดเขต ทฤษฎีบทหลักมูลของแคลคูลัส เทคนิคการหาปริพันธ์ การประยุกต์การหาปริพันธ์ ระบบสมการเชิงอนุพันธ์สามัญสนามทิศทางและรูปเฟส ตัวแทนเมทริกซ์ ผลเฉลยนิ่ง ผลเฉลยโดยวิธีค่าลักษณะเฉพาะ การประยุกต์ ระบบสมการเชิงอนุพันธ์สามัญ</p> <p>A review of calculus, chain rule and derivatives of inverse functions, derivatives of trigonometric, inverse trigonometric, exponential and logarithmic functions, implicit differentiation and related rates; applications of derivatives, antiderivatives, definite and indefinite integrals, fundamental theorems of calculus; techniques of integration, applications of integration, systems of ordinary differential equations, direction fields and phase portraits, matrix representation, stationary solutions, solutions by eigenvalue method; applications of systems of ordinary differential equations</p>	
วทฟส ๑๘๐ SCPY 180	ฟิสิกส์ทั่วไป General Physics	3 (3-0-6)
	<p>วิชาบังคับก่อน: ไม่มี Prerequisites: No</p> <p>กลศาสตร์ กลศาสตร์ของไหล อุณหพลศาสตร์ คลื่นและทัศนศาสตร์ ไฟฟ้าแม่เหล็ก ฟิสิกส์ยุคใหม่ Mechanics, fluid mechanics, thermodynamics, wave and optics, electromagnetism, modern physics</p>	
วทฟส ๑๑๑ SCPY 111	ปฏิบัติการฟิสิกส์ขั้นพื้นฐาน Basic Physics Laboratory	1 (0-3-1)



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	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p> <p>การทดลองฟิสิกส์ขั้นพื้นฐานเน้นทักษะเกี่ยวกับการวัด การบันทึกผล และวิเคราะห์ผล การเชื่อมโยงการทดลองเข้ากับทฤษฎีในหัวข้อกลศาสตร์ เทอร์โมไดนามิกส์ และ ไฟฟ้าแม่เหล็ก</p> <p>Basic physics experiments emphasizing on measurement, data-recording and data-analysis skills in the topics related to and supporting a theoretical study on mechanics, thermodynamics, and electromagnetism</p>	
<p>วททส ๑๐๑</p> <p>SCBE 101</p>	<p>ชีววิทยาทั่วไป ๑</p> <p>General Biology 1</p>	<p>3 (3-0-6)</p>
	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p> <p>ชีววิทยาพื้นฐานและสาขาวิชาทางชีววิทยา ชนิดของสารชีวโมเลกุล ชนิดของเซลล์ และเนื้อเยื่อ การเจริญเติบโตและเมตาบอลิซึมของเซลล์ ปัจจัยที่ส่งผลต่อการเจริญเติบโตและการมีชีวิต การแบ่งเซลล์ พันธุศาสตร์ แบบแผนการถ่ายทอดลักษณะทางพันธุกรรม พันธุศาสตร์ระดับโมเลกุล เทคโนโลยีดีเอ็นเอรีคอมบิแนนท์ วิวัฒนาการ นิเวศวิทยา ชีววิทยาสภาวะแวดล้อมและการอนุรักษ์</p> <p>Basic biology and fields of biology; types of biological molecules; types of cells and tissues; the growth and metabolic processes of cells; factors affecting growth and survival of living things; cell division; genetics; pattern of inheritance; molecular genetics; recombinant DNA technology; evolution; ecology; environmental biology and conservation</p>	
<p>วททส ๑๐๒</p> <p>SCBE 102</p>	<p>ปฏิบัติการชีววิทยาทั่วไป ๑</p> <p>General Biology Laboratory 1</p>	<p>1 (0-3-1)</p>
	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p> <p>กล้องจุลทรรศน์ การเคลื่อนที่ของโมเลกุล เซลล์และออร์แกเนลล์ เนื้อเยื่อพืช เนื้อเยื่อสัตว์ การแบ่งเซลล์ พันธุศาสตร์ประชากร ชีววิทยาพฤติกรรม นิเวศวิทยาและชีววิทยาสภาวะแวดล้อม</p>	



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	Microscope; movement of molecules; cells and organelles; plant tissues; animal tissues; cell division; population genetics; behavioral biology; ecology and environmental biology	
วทชพ ๑๒๑ SCBM 121	ชีววิทยาระดับเซลล์และโมเลกุล Cell and Molecular Biology	2 (2-0-4)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No โครงสร้างและหน้าที่ของเซลล์ ชีวิตและการส่งผ่านข้อมูลภายในเซลล์ การส่งผ่านพลังงานในระบบชีวภาพ การส่งสัญญาณของเซลล์ การแบ่งตัวของเซลล์ การพัฒนาเป็นเซลล์ชนิดจำเพาะ การตายและการพัฒนาของเซลล์ Cell structures and functions, life and information flow in cell, energy flow in the biosystem, cell structures and functions, cell signaling, cell divisions, cellular differentiation, cell death and development.	
วทคณ ๒๕๙ SCMA 259	พีชคณิตเชิงเส้น Linear Algebra	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No ปริภูมิเวกเตอร์ การแปลงเชิงเส้น ปริภูมิผลคูณภายใน ภาพฉายบนปริภูมิย่อย ค่ากำลังสองน้อยที่สุด ค่าลักษณะเฉพาะและเวกเตอร์ลักษณะเฉพาะ การแปลงเป็นเมทริกซ์เฉียงและจอร์แดน ปริภูมิเวกเตอร์เชิงซ้อน การแยกค่าเอกฐาน ตัวผกผันเทียม ระบบสมการอนุพันธ์เชิงเส้น Vector spaces, Linear transformations, inner product spaces, projections on to subspaces, Least squares, Eigenvalues and Eigenvectors; diagonalization and Jordan forms; complex vector spaces, singular value decomposition and the pseudouniverse; systems of linear differential equations	
วทวน ๒๑๑ SCME 211	การโปรแกรมคอมพิวเตอร์และการจำลอง Computer Programming and Simulation	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No	



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	ความรู้ทั่วไปเกี่ยวกับคอมพิวเตอร์แบบดิจิทัล โปรแกรมคอมพิวเตอร์ ภาษาที่ใช้เขียนโปรแกรม และการเขียนโปรแกรมคอมพิวเตอร์ ระบบเชิงตัวเลข อัลกอริทึมสำหรับการค้นหาและการเรียงลำดับ การสร้างแบบจำลอง General knowledge of digital computers, computer programs, programming languages and computer programming; flow charting, the numerical system, algorithms for searching and sorting; the model simulation	
วทวน ๒๒๒ SCME 222	เคมีเชิงฟิสิกส์และอุณหพลศาสตร์ Physical Chemistry and Thermodynamics	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No อุณหพลศาสตร์และจลนพลศาสตร์ในกระบวนการเคมีครอบคลุมระบบแก๊ส สารละลายสมดุลระหว่างวัฏภาค และสารละลายนำไฟฟ้า ทฤษฎีและกลไกของปฏิกิริยาที่ใช้อธิบายอัตราการเกิดปฏิกิริยาในระบบเชิงเคมี และระบบชีวภาพ Thermodynamics and kinetics with applications to gasses, solutions; phase equilibria and electrolyte; theories and reaction mechanisms used for explaining the rate of reactions in the chemical and biological systems	
วทวน ๒๓๑ SCME 231	โมเดิร์นฟิสิกส์และกลศาสตร์ควอนตัม Modern Physics and Quantum Mechanics	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No คลื่น ออปติคส์ แม่เหล็กไฟฟ้า ฟิสิกส์ระดับอะตอมและที่มาของกลศาสตร์ควอนตัม สมการของชโรดิงเงอร์ ทฤษฎีสถานะตรงตัว แบบจำลองของฮาร์ทรี่ฟ็อก การทำให้พอดีทางรูปทรงโครงสร้างอิเล็กทรอนิกส์ Waves, optics, and electromagnetism; atomic physics along with the development of quantum mechanics; Schrodinger's equation, self-consistent field theory, Hartree-Fock model, geometry optimization and electronic structure	
วศอก ๑๙๕ EGIE 195	ปฏิบัติการวิศวกรรมพื้นฐาน Basic Engineering Workshops	3 (2-2-5)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No	



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	<p>เขียนแบบวิศวกรรมเบื้องต้น เครื่องมือสำหรับเขียนแบบวิศวกรรม การใช้คอมพิวเตอร์ช่วยในการออกแบบขั้นพื้นฐาน กรรมวิธีการผลิตเบื้องต้น อุปกรณ์และเครื่องมือสำหรับกรรมวิธีการผลิตความปลอดภัยขั้นพื้นฐานสำหรับปฏิบัติการวิศวกรรม</p> <p>Fundamentals of engineering drawing; tools for engineering drawing; basic computer aided design; fundamentals of manufacturing processes; equipment and tools for manufacturing processes; basic safety for engineering workshops</p>
วศอก ๒๙๕ EGIE 295	<p>กลศาสตร์สำหรับวิศวกรรมวัสดุ</p> <p>Mechanics for Materials Engineers</p> <p>3 (3-0-6)</p>
	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p> <p>เวกเตอร์แรง สมดุลของวัตถุแข็ง ความสัมพันธ์ของความเค้นและความเครียด ความเค้น การเฉือน โมเมนต์ดัด การบิด และการโก่ง วงกลมของโม่ร์ กลศาสตร์ต่อเนื่องขั้นพื้นฐาน จุดครากและความเค้น กลศาสตร์ขั้นพื้นฐานในโครงสร้างระดับนาโน</p> <p>Force vectors; equilibrium of rigid body; stress and strain relationship; stress, shear, moment, torsion and buckling; Mohr's circle; basic continuum mechanics, yield point and stress; basic mechanics in nanostructure</p>
วทวน ๒๖๔ SCME 264	<p>วัสดุนาโนและการประยุกต์</p> <p>Nanomaterials and Applications</p> <p>3 (3-0-6)</p>
	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p> <p>วิธีการสร้างโครงสร้างระดับนาโน วัสดุนาโน และอุปกรณ์ระดับนาโน เทคนิคการทำ deposition การปลูกโครงสร้างวัสดุและการจัดเรียงตัวด้วยตัวเองของโครงสร้างนาโน การนำวัสดุนาโนไปใช้ในชีวิตรจริง คุณสมบัติที่หลากหลายและการนำไปใช้ในทางการแพทย์และอุปกรณ์อิเล็กทรอนิกส์ในอนาคต</p> <p>Methods for producing nanostructures, nanostructured materials and nanoscale devices, using deposition, growth and self-assembling processes; using real-world examples to demonstrate how the unique properties of these materials can be tailored for a wide range of applications from novel building materials and medical prosthetics to the next generation of electronic devices</p>



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วทวน ๑๐๑ SCME 101	หลักการขั้นแนะนำทางวัสดุศาสตร์ Introduction to Materials	3 (3-0-6)
	<p>วิชาบังคับก่อน: ไม่มี Prerequisites: No</p> <p>พื้นฐานความรู้เกี่ยวกับวิศวกรรมวัสดุ และวิทยาศาสตร์ที่เกี่ยวข้องกับวัสดุ ความสามารถในการแก้ปัญหาเกี่ยวกับวัสดุ และมีเข้าใจคุณสมบัติของวัสดุ พันธะและโครงสร้างของอะตอมของของแข็งแบบผลึก ความไม่สมบูรณ์ในผลึก การแพร่ สมบัติเชิงกลของโลหะ การเลื่อนจากตำแหน่งและกลไกการระคายความแข็ง ความล้าเหลว แผนภาพเฟสและการแปลงเฟสในโลหะ กรรมวิธีทางความร้อนของโลหะและโลหะผสม เซรามิกส์และแก้ว พอลิเมอร์ กรรมวิธีการขึ้นรูปพอลิเมอร์ การกัดกร่อน วัสดุนาโน</p> <p>Fundamental knowledge about materials engineering and science related to materials; an ability to solve materials problems and understand properties of materials; bonding and atomic structure of crystalline solids, defects in crystals, diffusion; mechanical properties of metals, dislocations, hardening, failure, phase diagram and phase change in metals; heat treatment of metals and alloys, ceramics and glass, polymers, polymer processing, corrosion, nano-materials</p>	
วทวน ๒๐๒ SCME 202	หลักการเบื้องต้นของเซรามิก Basic Principle of Ceramics	3 (3-0-6)
	<p>วิชาบังคับก่อน: วทวน ๑๐๑ หลักการขั้นแนะนำทางวัสดุศาสตร์ Prerequisites: SCME 101 Introduction to Materials</p> <p>ลักษณะเฉพาะเชิงโคเวเลนต์และไอออนิก สมบัติโครงสร้างของเซรามิก การสังเคราะห์และการขึ้นรูป สมบัติเชิงกล สมบัติอิเล็กทรอนิกส์ สมบัติแม่เหล็ก และสมบัติเชิงแสงของเซรามิก</p> <p>Covalent and ionic characters, structural properties of ceramics; synthesis and processing, mechanical-, electronic-, magnetic- and optical-properties of ceramics</p>	
วทวน ๒๐๓ SCME 203	กายภาพของโลหะ Physical Metallurgy	3 (3-0-6)
	<p>วิชาบังคับก่อน: วทวน ๑๐๑ หลักการขั้นแนะนำทางวัสดุศาสตร์ Prerequisites: SCME 101 Introduction to Materials</p>	



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	<p>โครงสร้างของโลหะ ข้อบกพร่อง ของผลึก การแพร่ เฟอร์ไรต์ลอสต์ นอนเฟอร์ไรต์ลอสต์ และ หลักการเปลี่ยนแปลงเฟสของโซลิตัสเตท ความสัมพันธ์ระหว่างโครงสร้างแบบจุลภาค และ คุณสมบัติทางกล การขึ้นรูปเบื้องต้น</p> <p>Metallic structure, defects, crystalization, diffusion, ferrous alloy, non-ferrous alloy, phase transformation, microstructure and mechanical properties; basic metal forming</p>	
<p>วทวน ๒๖๓ SCME 263</p>	<p>นาโนเทคโนโลยีทางชีวภาพ Nanobiotechnology</p>	<p>3 (3-0-6)</p>
	<p>วิชาบังคับก่อน: วทชพ ๑๒๑ ชีววิทยาระดับเซลล์และโมเลกุล Prerequisites: SCBM 121 Cell and Molecular Biology</p> <p>ความสำคัญของนาโนเทคโนโลยีในระบบชีววิทยา การเลียนแบบระบบที่ถูกสร้างโดยธรรมชาติ เพื่อให้เกิดการประยุกต์ต่างๆ การจัดวางโมเลกุลอย่างเป็นระเบียบได้ด้วยตนเอง ระบบ อเนกประสงค์ที่ระดับนาโนสเกล การพัฒนาระบบตรวจวัดทางชีวภาพ ชีววิทยาทางการแพทย์ด้วย นาโนเทคโนโลยี การประยุกต์ใช้วัสดุในงานด้านต่างๆ</p> <p>The importance of nanotechnology in the biological system; mimicking the natural system for new applications; self-assembling complex; the multi-functional system at the nanoscale; developing the new biosensing, biomedical systems by using nanotechnology; its applications to various kinds of work</p>	
<p>วทวน ๒๘๒ SCME 282</p>	<p>โครงการนวัตกรรมวัสดุ ๑ Materials Innovation Project I</p>	<p>1 (0-3-1)</p>
	<p>วิชาบังคับก่อน: ไม่มี Prerequisites: No</p> <p>ทำโครงการวิจัยที่เกี่ยวข้องกับการสร้างนวัตกรรมของวัสดุศาสตร์ Carrying out research projects related to materials innovations</p>	
<p>วทวน ๒๘๓ SCME 283</p>	<p>โครงการนวัตกรรมวัสดุ ๒ Materials Innovation Project II</p>	<p>1 (0-3-1)</p>
	<p>วิชาบังคับก่อน: ไม่มี Prerequisites: No</p> <p>ทำโครงการวิจัยที่เกี่ยวข้องกับการสร้างนวัตกรรมของวัสดุศาสตร์และการประยุกต์ Carrying out research projects related to materials innovation and applications</p>	



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วทวน ๓๐๑ SCME 301	การใช้เครื่องมือสำหรับวัสดุศาสตร์และวิศวกรรมนาโน Instrumental Methods for Materials Science and Nanoengineering	3 (3-0-6)
	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p> <p>หลักการพื้นฐานการวิเคราะห์ด้วยเครื่องมือ สเปกโทรเมทรีของแสง การดูดกลืนแสงแบบอะตอมมิก แอ็บซอร์พชัน การเปล่งแสงแบบอะตอมมิก อิมิสชัน การศึกษาสมบัติของวัสดุด้วยเทคนิคทางแสง คอนดักโทเมทรี โฟเทนซิโอเมทรี แอมเพโรเมทรี คูลอมบ์เมทรี โครมาโทกราฟีแบบของเหลว แก๊สโครมาโทกราฟี ไอออนโครมาโทกราฟี นิวเคลียร์แมกเนติกเรโซแนนซ์ หลักการของเครื่องโอเจอเล็กตรอน ไมโครสโคปี หลักการของกล้องจุลทรรศน์อิเล็กตรอนทั้งแบบส่องกราดและแบบทะลุผ่าน หลักการของเครื่องสแกนแบบแรงอะตอม และแบบทันเนลิ่ง หลักการเครื่องสเปกโตรสโคปีของอนุภาคอิเล็กตรอนจากรังสีเอกซ์ เครื่องวิเคราะห์การเลี้ยวเบนรังสีเอกซ์ และเครื่องสเปกโตรเมทรีของมวลไอออนทุติยภูมิ</p> <p>Basic principles in analytical instrument techniques; UV-Visible spectrometry; atomic absorption spectrometry; (FTIR, UV-Vis and Raman); atomic emission spectrometry; conductometry; potentiometry; amperometry; coulombmetry; liquid chromatography; gas chromatography; ion chromatography; nuclear magnetic resonance; auger electron spectroscopy; scanning electron microscopy; tunneling electron microscopy; atomic force microscopy; scanning tunneling microscopy; X-ray photoelectron spectroscopy; x-ray diffraction; secondary ion mass spectroscopy</p>	
วทวน ๓๒๑ SCME 321	วิทยาศาสตร์พอลิเมอร์และการขึ้นรูป Principle of Polymer Science and Processing	3 (3-0-6)
	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p> <p>ประวัติ และที่มาของพอลิเมอร์ การศึกษาพอลิเมอร์ในด้านต่างๆ ประกอบด้วย การสังเคราะห์ การศึกษาสมบัติ การศึกษาโครงสร้าง สมบัติเชิงกล สมบัติเชิงไฟฟ้า พอลิเมอร์นาโนเทคโนโลยี</p> <p>Origin of polymer science, polymer synthesis, polymer characterization, polymer structure, mechanical property of polymer, polymer in nanotechnology</p>	



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วทวน ๓๗๓ SCME 373	วัสดุศาสตร์และวิศวกรรมนาโนในระบบโรงงานอุตสาหกรรม Materials Science and Nanoengineering in Industrial Process	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No ความรู้เบื้องต้นเกี่ยวกับขั้นตอนทางอุตสาหกรรมสำหรับผลิตภัณฑ์ต่างๆ การเลือกวัสดุที่ใช้ในการทำเครื่องจักรและอุตสาหกรรมต่างๆ การออกแบบโมลด์ และการออกแบบชิ้นส่วนเครื่องจักรอื่นๆ การประกอบชิ้นส่วนเครื่องจักรในอุตสาหกรรมที่เกี่ยวข้องกับวัสดุศาสตร์และวิศวกรรมนาโน การเยี่ยมชมโรงงานอุตสาหกรรมที่เกี่ยวข้อง Fundamental knowledge of material science and nanoengineering in industrial processing; materials for machine and industries, mold and industrial part design, industrial machine components and assembly; visiting related industries	
วทวน ๓๓๐ SCME 330	ฟิสิกส์สถานะแข็งสำหรับวัสดุศาสตร์ Solid-State Physics for Materials Science	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No พันธะเคมีในของแข็ง โครงสร้างของของแข็ง การเลี้ยวเบนจากโครงสร้างผลึก พลศาสตร์อะตอมในผลึก สมบัติทางความร้อน อิเล็กตรอนอิสระในของแข็ง แลบพลังงานของของแข็ง การเคลื่อนที่ของอิเล็กตรอนและขบวนการขนส่ง สมบัติไดอิเล็กทริก สารกึ่งตัวนำ Chemical bonding in solids; structure of solid matter; diffraction from periodic structures; dynamics of atoms in crystals; thermal properties; free electrons in solids; the electronic bandstructure of solids; motion of electrons and transport phenomena; dielectric properties of materials; semiconductors	
วทวน ๓๖๑ SCME 361	สารกึ่งตัวนำและนาโนอิเล็กทรอนิกส์ Semiconductor and Nanoelectronics	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No โครงสร้างแถบพลังงานของสารกึ่งตัวนำ ทฤษฎีการขนส่ง ทฤษฎีการกระจาย การดูดกลืนและการปล่อยรังสี ไดโอดรอยต่อ พี-เอ็น รอยต่อโลหะและสารกึ่งตัวนำ ทรานซิสเตอร์ชนิดรอยต่อไบโพลาร์ รอยต่อโลหะ-ออกไซด์-สารกึ่งตัวนำ กระบวนการสร้างอุปกรณ์ วงจรรวม อุปกรณ์อิเล็กทรอนิกส์มิติต่ำ อุปกรณ์นาโนอิเล็กทรอนิกส์	



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	Band structure of semiconductor; transport theory; diffusion theory; absorption and emission of radiation; P-N junction devices; metal-semiconductor contact, bipolar junction transistor; metal-oxide-semiconductor (MOS) junction; device fabrication process; integrated circuits; low dimensional electronic devices; nanoelectronic devices	
วทนว ๓๐๕ SCIN 305	ทักษะสำคัญสำหรับการวิจัยทางวิทยาศาสตร์ Essential Skills for Scientific Research	1 (1-0-2)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No การออกแบบการทดลอง การเก็บข้อมูลอย่างมีประสิทธิภาพ การบันทึกข้อมูลของห้องปฏิบัติการ การออกแบบการทดลอง การวิเคราะห์ข้อมูลทางสถิติ การใช้โปรแกรม R ความปลอดภัยทางชีวภาพ ความปลอดภัยทางเคมี ความปลอดภัยด้านไฟฟ้า ความซื่อสัตย์ทางวิชาการ การคัดลอกงาน จริยธรรม ลิขสิทธิ์ Research planning; effective data collection; lab notebook writing; experimental Design; basic statistical analysis; basic in R programming; biological safety; chemical safety; electrical safety; academic integrity; plagiarism; ethics and copyright.	
วทนว ๓๘๑ SCME 381	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์และวิศวกรรมนาโน ๑ Research Laboratory in Materials Science and Nanoengineering I	1 (0-3-1)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No ทฤษฎีและการฝึกปฏิบัติของเทคนิคหลักในวัสดุศาสตร์และวิศวกรรมนาโน การสังเคราะห์สาร การวัดสมบัติของวัสดุอาศัยหลักการพื้นฐาน ควบคุมกระบวนการผลิต การวัดการเลี้ยวเบนของรังสีเอ็กซ์ การดูดกลืนของแสงสเปคโตรสโคปีของแสงอินฟราเรด Theories and practical work on major techniques in materials science and nanoengineering, materials synthesis, design, processing, x-ray diffraction, optical absorption, FTIR spectroscopy	
วทนว ๓๘๒ SCME 382	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์และวิศวกรรมนาโน ๒ Research Laboratory in Materials Science and Nanoengineering II	1 (0-3-1)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No	



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	ทฤษฎีและการฝึกปฏิบัติการของเทคนิคหลักในวัสดุศาสตร์และวิศวกรรมนาโน การใช้กล้องจุลทรรศน์อิเล็กตรอน การวิเคราะห์พื้นผิว การใช้กล้องจุลทรรศน์แรงอะตอม Theories and practical work on major techniques in materials science and nanoengineering; electron microscopy, surface analysis, atomic force microscopy	
วทวน ๓๘๖ SCME 386	สัมมนาวัสดุศาสตร์และวิศวกรรมนาโน Seminar in Materials Science and Nano Engineering	1 (0-3-1)
	วิชาบังคับก่อน: วทวน ๑๐๑ หลักการขั้นแนะนำทางวัสดุศาสตร์ Prerequisites: SCME 101 Introduction to Materials นักศึกษาทำการศึกษาค้นคว้าเพื่อให้สัมมนาในหัวข้อที่ได้รับมอบหมาย Literature search, giving seminars on assigned topics	
วทวน ๔๘๖ SCME 486	โครงการวิจัยวัสดุศาสตร์ Materials Science Research Project	9 (0-27-9)
	วิชาบังคับก่อน: วทวน ๑๐๑ หลักการขั้นแนะนำทางวัสดุศาสตร์ Prerequisites: SCME 101 Introduction to Materials ค้นคว้าและวิจัยในหัวข้อที่ได้รับมอบหมาย วิเคราะห์ วิจัยผลงานวิจัย สร้างงานวิจัยด้านวัสดุศาสตร์และวิศวกรรมนาโน Carrying out research on the assigned topic, analyzing, discussing, and creating research in materials science and nanoengineering	

3. Major Elective Courses in materials science and nanoengineering

วทวน ๒๖๐ SCME 260	กระบวนการทางพื้นผิว Surface Process	3 (3-0-6)
	วิชาบังคับก่อน: วทวน ๑๐๑ หลักการขั้นแนะนำทางวัสดุศาสตร์ Prerequisites: SCME 101 Introduction to Materials เคมีพื้นผิวและอินเทอร์เฟซ เทอร์โมไดนามิกเชิงพื้นผิว แรงตึงผิว กระบวนการดูดซับที่อุณหภูมิต่ำที่สารควบคู่ การกระจายตัวขณะเปียก พื้นผิวและคอลลอยด์ ความเข้าใจทางด้านคุณสมบัติระหว่างพื้นผิวของสารสองชนิด คุณสมบัติเชิงเคมีของรอยต่อวัสดุและความสำคัญในศาสตร์ในระดับนาโน Investigating the chemistry of surfaces and interfaces, covering such topics as surface thermodynamics yielding concepts of surface energy of solids; covering surface tension of liquids, adsorption isotherms, surfactants and micelles, wetting	



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	spreading, and surface energy and colloidal (or nanoparticulate) systems, emphasizing on the chemistry of interfaces in underpinning the development of the nanoscale systems	
วทวน ๒๖๑ SCME 261	เครื่องสแกนนิ่งโพรบและกล้องจุลทรรศน์อิเล็กตรอน Scanning Probe and Electron Microscopy	3 (3-0-6)
	<p>วิชาบังคับก่อน: วทวน ๑๐๑ หลักการขึ้นแนะนำทางวัสดุศาสตร์ Prerequisites: SCME 101 Introduction to Materials</p> <p>การตรวจสอบและสร้างวัสดุ อุปกรณ์ และระบบทางชีวภาพด้วยโครงสร้างระดับนาโน การใช้ อุปกรณ์ต่างๆที่เกี่ยวข้องอย่างแม่นยำ เทคนิคสำหรับเครื่อง scanning tunneling และ atomic force ในการจัดการโครงสร้างระดับนาโนและระดับอะตอม หลักการของเครื่องจุลทรรศน์ อิเล็กตรอน การใช้เครื่องจุลทรรศน์อิเล็กตรอนสำหรับงานทางวิทยาศาสตร์และเทคโนโลยี การ พัฒนาล่าสุดของกล้องจุลทรรศน์อิเล็กตรอน และการใช้เครื่องจริงเบื้องต้น</p> <p>Characterisation and production of materials, devices, biological systems with nanoscale features requiring an analysis and manipulation tools with extreme precision; the advent of techniques such as scanning tunnelling or atomic force microscopy to view and manipulate objects at this level; using the electron microscope for the science and technology; recent developments in the techniques; hands-on experience using a variety of scanning probe and electron microscopes</p>	
วทวน ๓๓๒ SCME 332	วัสดุแม่เหล็กและวัสดุอิเล็กทรอนิกส์ Magnetic and Electronic Materials	3 (3-0-6)
	<p>วิชาบังคับก่อน: ไม่มี Prerequisites: No</p> <p>พื้นฐานความรู้เกี่ยวกับสนามแม่เหล็ก การเหนี่ยวนำทางแม่เหล็ก เส้นโค้งฮิสเตอร์เรซิสของ แม่เหล็ก แอนไอโซโทรปีในแม่เหล็ก ความร้อนและการคงตัวของแอนไอโซโทรปี วัสดุแม่เหล็ก และอุปกรณ์สมัยใหม่ กฎของโอมส์ ค่าการนำไฟฟ้า โลหะ ฉนวน และวัสดุกึ่งตัวนำใน อิเล็กทรอนิกส์ ไบโพล่าทรานซิสเตอร์ ทรานซิสเตอร์ผลสนามไฟฟ้า ระบบไฟฟ้าเชิงกลไมโครและ นาโน และอุปกรณ์อิเล็กทรอนิกส์สมัยใหม่</p> <p>Basic knowledge in the magnetic field, magnetic polarization, magnetic induction, hysteresis loop, magnetic anisotropy, thermal and anisotropy, magnetic media</p>	



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	and modern magnetic device; Ohms law, electrical conductivity, metal, insulator and semiconductor in electronics, bipolar transistor, field effect transistor, micro/nano electro mechanical system (MEMs and NEMs), modern electronic device	
วทวน ๓๓๓ SCME 333	เทคโนโลยีฟิล์มบางและการประดิษฐ์โครงสร้างนาโน Thin Film Technology and Nanostructure Fabrication	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No วัสดุสองมิติในอุดมคติ คุณสมบัติของฟิล์มบาง ลักษณะทางฟิสิกส์ของการฟอร์มตัวและโตขึ้นของฟิล์มบาง เทคนิคการปลูกโครงสร้างนาโน การตรวจสอบโครงสร้างนาโน การนำไปใช้ของโครงสร้างนาโน Ideal 2 dimension material, thin film properties and characteristics, physics of thin film nucleation and growth, nanostructure formation techniques, nanostructure analysis, nanostructure applications.	
วทวน ๓๖๐ SCME 360	ทัศนศาสตร์ Optics	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No พฤติกรรมและสมบัติของแสง การเกิดปฏิสัมพันธ์ของแสงกับสสาร การวิเคราะห์การเกิดอันตรกิริยาระหว่างสนามแม่เหล็กไฟฟ้าเคลื่อนที่กับสสารโดยใช้หลักการของเวกเตอร์แคลคูลัสและสมการดิฟเฟอเรนเชียล เทคนิคที่มีความสำคัญต่อการทำปฏิบัติการพื้นฐานทางทัศนศาสตร์ การวิเคราะห์และการนำเสนอผลการทดลองทางทัศนศาสตร์ The behaviour and properties of light; the interactions between light and matters; an analysis of the interaction between the moving electromagnetic fields and matters by using the principles of vector calculus and differential equations; using important techniques in conducting basic optical laboratory; analyses and presentations of optical laboratory results	
วทวน ๓๖๒ SCME 362	นาโนโฟโตนิกส์ Nanophotonics	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี	



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	<p>Prerequisites: No</p> <p>พื้นฐานคลื่นและทัศนศาสตร์ในทางฟิสิกส์ กลวิธีทางเวกเตอร์และแคลคูลัสและอนุพันธ์ในการอธิบายปรากฏการณ์ของสนามที่เกิดขึ้นกับสสาร ปรากฏการณ์ที่เกิดขึ้นระหว่างสนามกับโครงสร้างนาโนและบทบาทที่มีกับชีววิทยา และโครงสร้างนาโนทางเคมี สมการของแมกซ์เวลล์และอันตรกิริยาของคลื่นแม่เหล็กไฟฟ้ากับสสาร การเลี้ยวเบน กระบวนการสร้างโฮโลแกรมจากเกรตติง กระบวนการทาง near field ออปติกส์ และนาโนโฟโตนิกส์</p> <p>The foundation studies of waves and optics undertaken in an introductory physics subjects; using the methods of vector calculus and differential equations to analyse how propagating fields interact with matter; Showing the important role of the field distributions at the nanoscale in many well-established and developing biological and chemical nanoscale analytic tools; Maxwell's equations, interaction of electromagnetic waves and matters, diffraction and holographic gratings, near-field optics and nanophotonics</p>	
วทวน ๓๘๔ SCME 384	การฝึกวิจัยวัสดุศาสตร์ Materials Science Research Practice	1 (0-3-1)
	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p> <p>ทำการวิจัยในหัวข้อที่เกี่ยวข้องกับวัสดุศาสตร์และวิศวกรรมนาโน</p> <p>Carrying out research in a topic related to materials science and nanoengineering</p>	
วทวน ๓๘๕ SCME 385	การฝึกวิจัยวัสดุศาสตร์และการประยุกต์ Materials Science Research Practice and Applications	1 (0-3-1)
	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p> <p>ทำการวิจัยในหัวข้อที่เกี่ยวข้องกับวัสดุศาสตร์และวิศวกรรมนาโนและการประยุกต์</p> <p>Carrying out research in a topic related to materials science and nanoengineering and applications</p>	
วทวน ๔๑๑ SCME 411	การเขียนโปรแกรมสำหรับระบบอัตโนมัติในกระบวนการผลิต Programing for Automatic System in Manufacturing Process	3 (3-0-6)
	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p>	



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	<p>ความจำเป็นสำหรับระบบการควบคุมอัตโนมัติในกระบวนการผลิต, อุตสาหกรรม 4.0, 5.0 กับ การผลิตวัสดุ, หลักการไมโครคอนโทรลเลอร์เบื้องต้น หลักการทำงานเบื้องต้นของระบบอัตโนมัติ การเขียนโปรแกรมไมโครคอนโทรลเลอร์ การทำงานของอินเทอร์เฟซเบื้องต้นระหว่างอุปกรณ์ต่างๆ และคอมพิวเตอร์ ตัวอย่างการใช้งานและการฝึกเขียนโปรแกรม</p> <p>Essential of automatic control in manufacturing processes, industrial 4.0, 5.0 in material production; basic microcontroller, basic principle of automatic system, microcontroller programing; interface principle between device and computer, examples of applications and practical works</p>	
<p>วทวน ๔๓๑ SCME 431</p>	<p>การจำลองโมเลกุล Molecular Simulation</p>	<p>3 (3-0-6)</p>
	<p>วิชาบังคับก่อน: ไม่มี Prerequisites: No</p> <p>ชุดทางสถิติ การอินทิเกรตสมการการเคลื่อนที่ วิธีการทางพลศาสตร์โมเลกุล วิธีการทางพลศาสตร์โมเลกุล วิธีมอนติ คาร์โล ปรากฏการณ์ขนส่ง การเขียนโปรแกรมคอมพิวเตอร์</p> <p>Statistical ensembles, an integration of equation of motion; molecular dynamics methods, Monte Carlo methods, transport phenomena, computer programming</p>	
<p>วทวน ๔๕๑ SCME 451</p>	<p>เครื่องมืออิเล็กทรอนิกส์และการเชื่อมต่อกับคอมพิวเตอร์ Electronic Instrument and Computing Interface</p>	<p>3 (3-0-6)</p>
	<p>วิชาบังคับก่อน: ไม่มี Prerequisites: No</p> <p>หลักการทางฟิสิกส์เชิงไฟฟ้า การนำแคลคูลัสและเลขเชิงซ้อนในการอธิบายฟิสิกส์เชิงไฟฟ้า ทฤษฎีเชิงปฏิบัติการด้านงานวงจรอิเล็กทรอนิกส์ อุปกรณ์และวงจรอิเล็กทรอนิกส์ เครื่องแปลงไฟฟ้ากระแสสลับ / กระแสตรง วงจรทรานซิสเตอร์และออปแอมป์ วงจรขยายสัญญาณ ดิจิตอล อิเล็กทรอนิกส์ ไมโครโปรเซสเซอร์ วงจรวัด การเชื่อมต่อกับคอมพิวเตอร์</p> <p>Fundamental electrical physics; knowledge of calculus and of complex numbers to explain electrical physics; theoretical skills in an application of electronic circuits, electronic devices and circuits, diodes, transistors and op-amps, signal amplifier circuits, digital electronics, microprocessors, measurement circuits, computer interfaces</p>	
<p>วทวน ๔๗๑</p>	<p>เทคโนโลยีวัสดุกึ่งตัวนำ</p>	<p>3 (3-0-6)</p>



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SCME 471	Semiconductor Technology	
	<p>วิชาบังคับก่อน: วทวน ๑๐๑ หลักการขึ้นแนะนำทางวัสดุศาสตร์ Prerequisites: SCME 101 Introduction to Materials</p> <p>ระบบโครงสร้างอะตอมของซิลิกอน คุณสมบัติเชิงฟิสิกส์ และอิเล็กทรอนิกส์ ของซิลิกอน การสร้างแผ่นซิลิกอนเวเฟอร์ เคมีเบื้องต้นในเทคโนโลยีวัสดุกึ่งตัวนำ ห้องคลีนรูมและเครื่องมือต่างๆภายใน ความรู้เกี่ยวกับโฟโตริซิสและการทำลิโทกราฟี พื้นฐานพลาสมาในเทคโนโลยีวัสดุกึ่งตัวนำ อุปกรณ์สมัยใหม่จากเทคโนโลยีวัสดุกึ่งตัวนำ</p> <p>Crystalization of silicon, physical properties of silicon, electronic structure of silicon, silicon formation; wet chemical in semiconductor technology, clean room and instruments in silicon technology, photoresist and lithography, basic plasma in semiconductor technology, modern devices from semiconductor technology</p>	
วทวน ๔๗๒ SCME 472	หัวข้อพิเศษทางวัสดุศาสตร์และวิศวกรรมนาโน Special Topics in Materials Science and Nanoengineering	3 (3-0-6)
	<p>วิชาบังคับก่อน: ไม่มี Prerequisites: No</p> <p>หัวข้อที่กำลังเป็นที่สนใจในปัจจุบันทางด้านวัสดุศาสตร์และวิศวกรรมนาโน Topics of current interests in materials science and nanoengineering</p>	
วทวน ๔๘๕ SCME 485	ฝึกงานวัสดุศาสตร์และวิศวกรรมนาโน Internship in Materials Science and Nanoengineering	9 (0-27-9)
	<p>วิชาบังคับก่อน: ไม่มี Prerequisites: No</p> <p>ฝึกงานในโรงงาน บริษัท หน่วยงานหรือวิสาหกิจต่างๆ ที่เกี่ยวข้องกับวัสดุศาสตร์และวิศวกรรมนาโน เป็นระยะเวลาอย่างน้อย 16 สัปดาห์ และสามารถขยายเวลาได้ตามแต่ความจำเป็น Practical work related to materials science and nanoengineering in industrial companies or research organizations for at least 16 weeks with an extension if necessary</p>	
วทวน ๓๔๑ SCME 341	ความเป็นพิษของวัสดุ Toxicology of Materials	3 (3-0-6)
	<p>วิชาบังคับก่อน: วทชพ ๑๒๑ ชีววิทยาระดับเซลล์และโมเลกุล Prerequisites: SCBM 121 Cell and Molecular Biology</p>	



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	<p>บทนำเรื่องความเป็นพิษของอนุภาค ความเป็นพิษของอนุภาควัสดุในเซลล์ที่มีชีวิตและสิ่งแวดล้อม ปฏิกริยาของอนุภาควัสดุกับเยื่อหุ้มเซลล์ การสะสมและการกระจายตัวทางชีวภาพของอนุภาค วัสดุ ผลกระทบของอนุภาควัสดุที่ทำให้เกิดการอักเสบของเซลล์ การทดสอบความเป็นพิษของ วัสดุ</p> <p>An introduction of toxicology of nanoscale material particles, cytotoxicity of particles in living cells and environment; interaction of particles with membranes, bioaccumulation and biodistribution of oparticles, proinflammatory effects of particles on cells; toxicological testing of material particles</p>	
วทวน ๓๔๒ SCME 342	นาโนเทคโนโลยีในการนำส่งยา Nanotechnology in Drug Delivery	3 (3-0-6)
	<p>วิชาบังคับก่อน: วทวน ๒๖๓ นาโนเทคโนโลยีทางชีวภาพ</p> <p>Prerequisites: SCME 263 Nanobiotechnology</p> <p>หลักการของอนุภาคนาโนในระบบการนำส่งยา คอลลอยด์ในระบบการนำส่งยา การนำส่งยา ภายในเซลล์ และการส่งผ่านไปยังเซลล์เป้าหมาย การใช้อนุภาคนาโนเป็นสารกระตุ้นการนำส่ง วัคซีน อนาคตของนาโนเทคโนโลยีในการนำส่งยา</p> <p>Principles of nanosized drug delivery system, the colloidal delivery system, drug release from the nanosized drug delivery system; intracellular delivery and targeting, nanoparticles as adjuvant for vaccine delivery; future of nanotechnology in the drug delivery</p>	
วทวน ๔๓๒ SCME 432	วัสดุที่มีความอ่อนตัวและการประยุกต์ใช้ทางชีวภาพ Soft Materials and Bioapplications	3 (3-0-6)
	<p>วิชาบังคับก่อน: วทวน ๑๐๑ หลักการขึ้นแนะนำทางวัสดุศาสตร์</p> <p>Prerequisites: SCME 101 Introduction to Materials</p> <p>โครงสร้างของวัสดุที่มีความอ่อนตัว การตอบสนองของเซลล์ต่อวัสดุอ่อนตัว ระบบของวัสดุที่มีความอ่อนตัว (พอลิเมอร์), คอลลอยด์, เจล, สารลดแรงตึงผิว, วัสดุอ่อนตัวในผลิตภัณฑ์ทางชีวภาพ: เครื่องสำอาง, แผ่นปิดบาดแผล, น้ำยาทำความสะอาด และบรรจุภัณฑ์อาหาร</p> <p>Soft material structures, cellular response to soft materials; soft material systems (polymers, colloids, gels, surfactant); soft materials in bioproducts: cosmetics, adhesives, detergents, food packing</p>	



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วทวน ๔๔๑ SCME 441	ชีววัสดุทางการแพทย์และอุปกรณ์สำหรับร่างกาย Biomedical Materials and Devices for Human Body Repair	3 (3-0-6)
	วิชาบังคับก่อน: วทวน ๒๖๓ นาโนเทคโนโลยีทางชีวภาพ Prerequisites: SCME 263 Nanobiotechnology คุณสมบัติของวัสดุที่ถูกใช้ในทางการแพทย์และทันตกรรม ปฏิกริยาระหว่างชีววัสดุและเนื้อเยื่อ สิ่งมีชีวิต โครงเลี้ยงเซลล์จากพอลิเมอร์ธรรมชาติและพอลิเมอร์สังเคราะห์ เทคโนโลยีการสร้าง ชิ้นงานอย่างรวดเร็วสำหรับวิศวกรรมเนื้อเยื่อและการผลิตโครงเลี้ยงเซลล์ Properties of materials used in medicine and dentistry; interactions between bio materials and living tissues; oxidation active biomaterial for wound healing; biomaterials for tissue engineering, natural and synthetic polymeric scaffolds; rapid prototyping technology for tissue engineering and scaffolds	
วทวน ๔๔๒ SCME 442	หัวข้อพิเศษทางวัสดุชีวการแพทย์ Special Topics in Biomedical Materials	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No หัวข้อที่กำลังเป็นที่สนใจในปัจจุบันทางด้านวัสดุชีวการแพทย์ Topics of current interest in biomedical materials.	
วทวน ๓๐๔ SCME 304	ความปลอดภัยและการจัดการของเสีย Safety and Waste Management	3 (3-0-6)
	วิชาบังคับก่อน: วทคม ๑๖๑ เคมีทั่วไป Prerequisites: SCCH 161 General Chemistry หลักการและทฤษฎีเกี่ยวกับวัตถุอันตรายและการลดความเสี่ยงต่ออันตราย ความเป็นอันตราย ของสารเคมี การจำแนกประเภทวัตถุอันตราย การจัดการวัตถุอันตราย การจัดการของเสีย	



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	Basic principles and theories in hazardous substances and how to reduce hazard risk, hazard of chemicals; classifications of hazardous substances, hazardous substance management, waste management	
วทวน ๓๒๔ SCME 324	การเสื่อมของวัสดุ Degradation of Materials	3 (3-0-6)
	วิชาบังคับก่อน: วทวน ๑๐๑ หลักการขึ้นแนะนำทางวัสดุศาสตร์ Prerequisites: SCME 101 Introduction to Materials การกัดกร่อนของโลหะในสภาวะสารละลายเป็นน้ำ เคมีไฟฟ้าเบื้องต้นของการกัดกร่อน การหาอัตราการกัดกร่อน รูปแบบการกัดกร่อน การป้องกันการกัดกร่อน การเสื่อมของพอลิเมอร์ การเสื่อมของเซรามิก การนำวัสดุกลับมาใช้ใหม่ Corrosion of metals in aqueous environment, basic electrochemistry of corrosion; corrosion rate determination, forms of corrosion, corrosion protection; degradation of polymer, degradation of ceramic, recycling of materials	
วทวน ๓๓๕ SCME 335	วัสดุอนินทรีย์ Inorganic Materials	3 (3-0-6)
	วิชาบังคับก่อน: วทคม ๑๖๑ เคมีทั่วไป Prerequisites: SCCH 161 General Chemistry โครงสร้างเชิงโมเลกุลโครงสร้างแบบขยาย การสังเคราะห์และการปรับเปลี่ยนโครงสร้างของวัสดุอนินทรีย์ วัสดุซึ่งประกอบด้วยโลหะทรานซิชัน ธาตุแลนทาไนด์และแอคติไนด์ พื้นผิวและผิวประจัน การพัฒนาที่เป็นปัจจุบันด้านเคมีวัสดุอนินทรีย์ Molecular and extended structures, synthesis and structural modification of inorganic materials, transition metal, lanthanide and actinide related materials; surface and interfaces; recent development in inorganic material chemistry	
วทวน ๓๖๔ SCME 364	นาโนเทคโนโลยีเชิงโมเลกุล Molecular Nanotechnology	3 (3-0-6)
	วิชาบังคับก่อน: วทคม ๑๖๑ เคมีทั่วไป Prerequisites: SCCH 161 General Chemistry นาโนเทคโนโลยีเชิงเคมี อันตรกิริยาของอะตอมและโมเลกุลขนาดใหญ่และขนาดเล็ก แรงที่ใช้ในการประกอบโมเลกุลขึ้นมา การเตรียมและวิเคราะห์อุปกรณ์ระดับโมเลกุล การใช้อุปกรณ์ระดับ	



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	<p>โมเลกุล อุปกรณ์ที่มีใช้ในปัจจุบัน เช่น ผลึกของเหลว การวิ่งของไอออนสำหรับงานทางเคมีและชีวโมเลกุล</p> <p>Focusing on the chemical basis of nanotechnology and the atomic and molecular interaction of small and large molecules, and how these forces can be used to assemble molecular devices; the preparation, characterisation and uses of molecular devices; existing molecular devices, such as liquid crystals and biological and synthetic ion-channels</p>
วทวน ๔๐๑ SCME 401	<p>วัสดุเชิงประกอบ</p> <p>Composite Materials</p> <p>2 (2-0-4)</p>
	<p>วิชาบังคับก่อน: วทวน ๑๐๑ หลักการขึ้นแนะนำทางวัสดุศาสตร์</p> <p>Prerequisites: SCME 101 Introduction to Materials</p> <p>หลักการของการยึดติด ชนิดของวัสดุเชิงประกอบ วัสดุเชิงประกอบชนิดผง วัสดุเชิงประกอบชนิดเส้นใย วัสดุเชิงประกอบเชิงโครงสร้าง กระบวนการขึ้นรูปวัสดุเชิงประกอบ สมบัติเชิงกล และสัณฐานวิทยาของวัสดุเชิงประกอบ หัวข้อปัจจุบันในการพัฒนาวัสดุเชิงประกอบ</p> <p>Principles of adhesion, types of composites, particulate composites, fiber composites, structural composites; composite processing, mechanical property and morphology of composites; current topics in composite developmen</p>
วทวน ๔๐๒ SCME 402	<p>การแปรรูปพลาสติกและเทคโนโลยียาง</p> <p>Polymer Processing and Rubber Technology</p> <p>3 (3-0-6)</p>
	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p> <p>การผสมและการสังเคราะห์พลาสติก เทคนิคการฉีดหล่อ การรีดรูป การเป่าหล่อ การกดอัด การขึ้นรูปร้อน การเหวี่ยงหล่อ สมบัติและการประยุกต์ทางธรรมชาติและยางสังเคราะห์ชนิดต่าง ๆ สารเคมีที่ใช้ในการผลิตยางผลิตภัณฑ์ กระบวนการผสมยาง กระบวนการขึ้นรูปและกระบวนการอบยาง</p> <p>Mixing and compounding of plastics, injection moulding, extrusion, blow moulding, compression moulding, thermoforming, rotational moulding; properties and applications of natural rubber and various types of synthetic rubbers; chemical used in rubber processing, rubber compounding, shaping and curing of rubber</p>



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วทวน ๔๒๑ SCME 421	เคมีอุตสาหกรรมสำหรับวัสดุศาสตร์ Industrial Chemistry for Materials Science	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No ภาพรวม ของอุตสาหกรรมเคมี แหล่งที่มาของวัตถุดิบในอุตสาหกรรมเคมี เศรษฐศาสตร์ อุตสาหกรรมเบื้องต้น กระบวนการคลออัลคาไลน์ อุตสาหกรรมปิโตรเคมี ผลิตภัณฑ์จาก อุตสาหกรรมปิโตรเคมีและพอลิเมอร์ กระบวนการขึ้นรูปพอลิเมอร์ ประเด็นด้านสิ่งแวดล้อมที่ เกี่ยวข้องกับอุตสาหกรรมเคมี An overview of chemical industry, raw materials for chemical industry; an introduction to industrial economics, chlor-alkaline process, petrochemical industry; products from petrochemical and polymer industries, polymer processing; environmental issues regarding to chemical industry	
วทวน ๔๒๒ SCME 422	วัสดุอินทรีย์และการขึ้นรูป Organic Materials and Processing	3 (3-0-6)
	วิชาบังคับก่อน: วทคม ๑๖๑ เคมีทั่วไป Prerequisites: SCCH 161 General Chemistry โครงสร้างโมเลกุล ปฏิกิริยาการสังเคราะห์พอลิเมอร์ อันตรกิริยาระหว่างพอลิเมอร์กับพอลิเมอร์ อันตรกิริยาระหว่างพอลิเมอร์กับโปรตีน วัสดุอินทรีย์ที่มีหน้าที่หลากหลาย รวมถึงถึงปฏิกรณ์นาโน ที่ทำจากพอลิเมอร์ พอลิเมอร์ที่สามารถนำไฟฟ้าได้และกระบวนการการเปลี่ยนแร่ธาตุทางชีวภาพ Molecular structures, polymer synthesis reactions, polymer-polymer interactions, polymer-protein interactions; multifunctional organic materials including polymeric nanoreactors; conducting polymers and biomineralization	
วทวน ๔๓๓ SCME 433	ปัญหาพิเศษทางวัสดุศาสตร์และวิศวกรรมนาโน Special Problems in Materials Science and Nanoengineering	3 (3-0-6)
	วิชาบังคับก่อน: ไม่มี Prerequisites: No ปัญหาที่กำลังเป็นที่สนใจในปัจจุบันทางวัสดุศาสตร์และวิศวกรรมนาโน Problems of current interests in materials science and nanoengineering	
วทวน ๔๖๑ SCME 461	นาโนเทคโนโลยีในวิทยาศาสตร์พอลิเมอร์ Nanotechnology in Polymer Sciences	3 (3-0-6)



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	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p> <p>สมบัติเฉพาะของวัสดุนาโน อนุภาคนาโน ควอนตัมดอท เส้นใยนาโน แท่งนาโน กราฟีน ฟิล์มบาง โครงสร้างนาโนแบบพิเศษ การพิสูจน์เอกลักษณ์วัสดุนาโน การประยุกต์ใช้วัสดุนาโน ผลกระทบของวัสดุนาโนที่มีต่อสังคม</p> <p>Unique properties of nanomaterials, nanoparticles, quantum dots, nanofibers, nanorods, graphene, thin films; characterization of nanomaterials; applications of nanomaterials; impact of nanomaterials on society</p>	
<p>วทวน ๓๗๕</p> <p>SCME 375</p>	<p>หลักสูตรพื้นฐานสำหรับนักวิทยาศาสตร์ผู้ประกอบการ</p> <p>Business Concepts for Science Entrepreneurs</p>	<p>3 (3-0-6)</p>
	<p>วิชาบังคับก่อน: ไม่มี</p> <p>Prerequisites: No</p> <p>หลักสูตรพื้นฐานหลายด้าน เช่น เศรษฐศาสตร์ การเงิน การลงทุน การตลาด บัญชี สำหรับนักวิทยาศาสตร์ผู้ประกอบการ การใช้ปัญหาที่น่าสนใจทางธุรกิจมาใช้ฝึกนักศึกษาเกี่ยวกับความคิดธุรกิจ และการให้นักศึกษาลองจำลองนำเสนอแผนธุรกิจจากงานวิจัยที่นักศึกษาสนใจ</p> <p>Covering many basic business ideas including basic economics, finance, investment, marketing, and accounting for science entrepreneurship; examining many real-world business cases and introducing of business talks with product or service ideas from student research interests</p>	

4. Courses of University of Technology Sydney, 96 Credits

33130	Mathematical Modeling I	6
	<p>This subject develops the knowledge and skills necessary for problem-solving and mathematical modelling at an introductory level. Differential calculus is applied to model situations in science and engineering that involve oscillations. Integral calculus is used to solve selected problems involving first- and second-order differential equations, and to calculate areas, volumes, lengths and other physical quantities. Vectors and matrices are introduced and applied to problem solving and modelling.</p>	



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33230	Mathematical Modelling II	6
	This subject consists of two parts: multivariate calculus and an introduction to statistics. The mathematical part develops the mathematical skills required for mathematical modelling of systems involving more than one independent variable. The statistics part is an introduction to descriptive statistics, statistical inference and simple linear regression. Topics include linear algebra, solutions to sets of equations resulting from particular problems, eigenvectors and eigenvalues, partial derivatives, optimisation, multiple integrals and their applications, and probability with a focus on the determination of the reliability of a system of components in various engineering contexts.	
33360	Mathematics for Physical Science	6
	Topics in this subject include a review of integration techniques; boundary value problems, separation of variables; Fourier series; heat and wave equations; Laplace's equation; the application of double and triple integrals to scientific problems; vector fields; line and surface integrals, and theorems of Gauss and Stokes.	
65307	Physical Chemistry I	6
	This subject is designed to provide students with a working knowledge of chemical thermodynamics, optical spectroscopy, and chemical kinetics, which can then be applied to other subjects within the course. Students are introduced to fundamental concepts in these areas and learn how to apply their principles in problem-solving situations.	
67509	Molecular Nanotechnology	6
	The subject focuses on the chemical basis of nanotechnology and the atomic and molecular interaction of small and large molecules, and how these forces can be used to assemble molecular devices. The preparation, characterisation and uses of molecular devices are discussed. Existing molecular devices, such as liquid crystals and biological and synthetic ion-channels are also discussed.	
68070	Introduction to Materials	6



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	<p>This subject develops a solid science foundation for further materials and engineering-related studies and facilitates the working relationship between engineers, materials scientists and other scientists; an ability to identify and solve materials problems; and an ability to relate properties of engineering materials to technical applications. Topics covered in this subject are: chemical bonding of materials, classification of materials, structure-property relationships, mechanical properties, heat treatment and strengthening mechanisms, ferrous and non-ferrous alloys, ceramics, polymers and composites, materials degradation, materials recycling and materials selection. Numerous applied examples are discussed. Laboratory work imparts practical skills and reinforces the underlying theories. This is an integral part of the subject along with tutorial workshops.</p>	
68201	Physics in Action	6
	<p>This subject is a foundation for later stage subjects. In this subject students learn about: electrostatics, dc circuits, magnetism, electromagnetism and induction, geometrical optics, physical optics, introductory atomic physics, and quantum theory. Research linked to each of the topic areas, and which is happening within the School of Physics and Advanced Materials at UTS, is integrated into this subject.</p>	
68316	Applied Electronics and Interfacing	6
	<p>This subject builds upon the foundation studies of electricity undertaken in an introductory physics subject. It assumes knowledge of calculus and of complex numbers. The subject develops practical and theoretical skills in the application of electronic circuits in the laboratory with particular emphasis on the development of computer interfacing applications. Op-amps and digital circuit components are treated as building blocks to functional interfacing systems. The Labview environment is used to build skills in programming a computer interface.</p>	
68320	Scanning probe and Electron Microscopy	6
	<p>Characterisation and production of materials, devices, biological systems with nanoscale features requires analysis and manipulation tools with extreme precision. This is a central issue in nanotechnology and many contemporary areas</p>	



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	of materials science. The advent of techniques such as scanning tunnelling or atomic force microscopy allows us to view and manipulate objects at this level. Electron microscopy has a more established history, but in more recent times has turned out to be an invaluable tool to the nanotechnologist. This is a hands-on subject that introduces the concepts behind these techniques, their use and application in many areas of science and technology. Recent developments in the techniques are introduced, and students have the opportunity to gain hands-on experience using a variety of scanning probe and electron microscopes.	
68412	Energy Science and Technology	6
	This subject explores the physics and thermodynamics of energy systems. It builds on the fluids and thermodynamics studied in introductory level subjects, and develops an understanding of the physics and thermodynamics underlying conventional and renewable energy systems. The subject builds problem-solving skills in practical applications of energy science. These systems and related issues are explored through lectures, tutorials and project-based work.	
68416	Computational Physics	6
	This subject introduces the key elements of computational physics such as methods for solving physical problems numerically and the use of computers for simulating the dynamics of large or complex systems. Numerical techniques including matrix manipulation, iterative optimisation and differential equation solvers. These are developed and applied to practical problems such as quantum mechanical simulations, statistical mechanics, electrodynamic fields and molecular dynamics. Project work leads students to advanced simulation work including processing and visualisation of results.	
68513	Nanophotonics	6
	This subject builds upon the foundation studies of waves and optics undertaken in an introductory physics subjects. It takes advantage of the methods of vector calculus and differential equations to analyse how propagating fields interact with matter. The subject shows that field distributions at the nanoscale play an important role in many well-established and developing biological and chemical	



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	nanoscale analytic tools. Topics may include: Maxwell's equations, interaction of electromagnetic waves and matter, diffraction and holographic gratings, near-field optics and nanophotonics.	
68606	Solid-state Science and Nanodevices	6
	This subject provides an introduction to the quantum mechanics of electrons in solids and shows how the basic principles are used to guide the development of nanodevices which have technological applications. The subject has a substantial laboratory component which provides an opportunity to work with nanostructured materials.	
91140	BioNanotechnology	6
	Biological systems are extremely important in nanotechnology and many new applications are being developed by mimicking natural systems. Biology is extremely good at self-assembling complex, multi-functional systems at the nanoscale, e.g. cell membranes or DNA. By understanding how these systems work, nanotechnologists are developing new biosensing, biomedical and materials applications, e.g. the ion-channel biosensor. This subject investigates the science that underlies these biological processes and how it is applied in contemporary nanotechnologies.	
68206	Optics	6
	The behaviour and properties of light, including its interaction with matter, underpin many of the technological developments of recent years. A thorough understanding of optics is necessary for careers in optics R&D, optical engineering, sales and technical support, and areas such as telecommunications, optical metrology and biomedical optics. This subject builds upon the foundation studies of waves and optics undertaken in an introductory physics subject. It takes advantage of the methods of vector calculus and differential equations to analyse how propagating electromagnetic fields interact with matter. The subject includes a significant experimental component, which teaches basic optical laboratory techniques and emphasises the importance of careful analysis and clear presentation of observations.	



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65212	Chemistry 2	6
	<p>The study of chemistry is central to an understanding of the physical world, and is fundamental to the study of biology, geology, and environmental science. This subject builds on and develops further the material introduced in Chemistry 1. The subject is divided into the broad areas of physical chemistry (equilibria, kinetics and thermochemistry) and organic chemistry (carbon compounds and their reactions, including biological molecules such as proteins, sugars and nucleic acids). The study of physical chemistry allows for the explanation and prediction of chemical reactivity and energetics, while organic chemistry provides the building blocks for understanding the complexity of the natural world.</p>	
68413	Quantum Physics	6
	<p>This subject builds on introductory material on waves and classical mechanics. The subject examines how the behaviour of our world at an atomic level differs from our everyday experience of the macroscopic world. It introduces concepts and quantum mechanical tools needed to describe the structure and interactions of atoms, molecules and solids. The unique properties of matter at this scale can be exploited in the creation of new materials and devices in nanotechnology. This subject explores emerging technologies such as quantum computing, scanning tunnelling microscopy, and spectroscopic tools used to characterise and investigate the atomic world. It provides material which is fundamental to understanding many areas of physics and chemistry together with contemporary applications which are relevant to nanotechnologists.</p>	



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3.2 Name, Surname, Identification Number, Academic Position, and Educational Qualifications of the Instructors Responsible for the Program

3.2.1 Instructors Responsible for the Program

No.	Name-Surname	Academic Position	Degree (field)/ Institute/ Graduation year	Most recent Academic Works in 5 years
1	Mr. Rakchart Traiphol	Asst Prof	- Ph.D. (Chemistry), Clemson University, USA: 2003 - B.Sc. (Chemistry), Khonkaen University: 1996	Potai, R., Faisadcha, K., Traiphol, R., Traiphol, N. Controllable thermochromic and phase transition behaviors of polydiacetylene/zinc(II) ion/zinc oxide nanocomposites via photopolymerization: An insight into the molecular level (2018) Colloids and Surfaces A: Physicochemical and Engineering Aspects, 555, pp. 27-36.
2	Ms. Chayanisa Chitichotpanya	Asst Prof	- Ph.D. (Materials Science and Engineering), University of Rochester, USA: 2004 - M.Sc. (Materials Science and Engineering), University of Rochester, USA: 1997	Chitichotpanya, P., Pisitsak, P., Chitichotpanya, C. Sericin-copper- functionalized silk fabrics for enhanced ultraviolet protection and antibacterial



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No.	Name-Surname	Academic Position	Degree (field)/ Institute/ Graduation year	Most recent Academic Works in 5 years
			- B.Sc. (Chemistry), Chulalongkorn University: 1992	properties using response surface methodology (2018) Textile Research Journal, 89, pp. 1166- 1179.
3	Mr. Pongsakorn Kanjanaboos	Asst Prof	- MS-PHD. (Physics), University of Chicago, USA: 2013 - BA (Physics and Economics), Washington University in Saint Louis, USA: 2008	Boonthum, C., Pinsuwan, K., Ponchai, J., Srikhirin, T., Kanjanaboos, P. Reconditioning perovskite films in vapor environments through repeated cation doping (2018) Applied Physics Express, 11 (6), art. no. 065503.
4	Mr. Tanant Waritanant	Lecturer	- Ph.D. (Engineering), University of Manitoba, Canada: 2017 - M.Sc. (Optics and Photonics), National Central University, Taiwan: 2011 - B. Eng. (Electronic) Chulalongkorn University: 2009	Nadimi, M., Waritanant, T., Major, A. Thermal lensing in Nd:GdVO4 laser with direct in-band pumping at 912 nm (2018) Applied Physics B: Lasers and Optics, 124 (8), 170.



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No.	Name-Surname	Academic Position	Degree (field)/ Institute/ Graduation year	Most recent Academic Works in 5 years
5	Mr. Yodchay Jompol	Lecturer	<ul style="list-style-type: none"> - Ph.D. in Physics, University of Cambridge, UK: 2008 - M.Sc. in Physics, Chalmers University of Technology, Sweden: 2001 - B.Sc. (Physics), Chulalongkorn University: 1998 	Roche, B., Roulleau, P., Jullien, T., Jompol, Y., Farrer, I., Ritchie, D.A., Glattli, D.C. Harvesting dissipated energy with a mesoscopic ratchet (2015) Nature Communications, 6, art. no. 6738

3.2.2 The Regular Instructors

No.	Name-Surname	Academic Position	Degree (field)/ Institute/ Graduation year	Most recent Academic Works in 5 years
1	Mr. Rakchart Traiphol*	Asst Prof	<ul style="list-style-type: none"> - Ph.D. (Chemistry), Clemson University, USA: 2003 - B.Sc. (Chemistry), Khonkaen University: 1996 	Potai, R., Faisadcha, K., Traiphol, R., Traiphol, N. Controllable thermochromic and phase transition behaviors of polydiacetylene/zinc(II) ion/zinc oxide nanocomposites via photopolymerization: An insight into the molecular level (2018) Colloids and Surfaces A:



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No.	Name-Surname	Academic Position	Degree (field)/ Institute/ Graduation year	Most recent Academic Works in 5 years
				Physicochemical and Engineering Aspects, 555, pp. 27-36.
2	Ms. Chayanisa Chitichotpanya*	Asst Prof	<ul style="list-style-type: none"> - Ph.D. (Materials Science and Engineering), University of Rochester, USA: 2004 - M.Sc.(Materials Science and Engineering), University of Rochester, USA: 1997 - B.Sc. (Chemistry), Chulalongkorn University: 1992 	Chitichotpanya, P., Pisitsak, P., Chitichotpanya, C. Sericin-copper-functionalized silk fabrics for enhanced ultraviolet protection and antibacterial properties using response surface methodology (2018) Textile Research Journal, 89, pp. 1166-1179.
3	Mr. Pongsakorn Kanjanaboos*	Asst Prof	<ul style="list-style-type: none"> - MS-PHD. (Physics), University of Chicago, USA: 2013 - BA (Physics and Economics), Washington University in Saint Louis, USA: 2008 	Boonthum, C., Pinsuwan, K., Ponchai, J., Sriksirin, T., Kanjanaboos, P. Reconditioning perovskite films in vapor environments through repeated cation doping (2018) Applied Physics Express, 11 (6), art. no. 065503.



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No.	Name-Surname	Academic Position	Degree (field)/ Institute/ Graduation year	Most recent Academic Works in 5 years
4	Mr. Tanant Waritanant*	Lecturer	<ul style="list-style-type: none"> - Ph.D. (Engineering), University of Manitoba, Canada: 2017 - M.Sc. (Optics and Photonics), National Central University, Taiwan: 2011 - B. Eng. (Electronic) Chulalongkorn University: 2009 	Nadimi, M., Waritanant, T., Major, A. Thermal lensing in Nd:GdVO ₄ laser with direct in-band pumping at 912 nm (2018) Applied Physics B: Lasers and Optics, 124 (8), 170.
5	Mr. Yodchay Jompol*	Lecturer	<ul style="list-style-type: none"> - Ph.D. in Physics, University of Cambridge, UK: 2008 - M.Sc. in Physics, Chalmers University of Technology, Sweden: 2001 - B.Sc. (Physics), Chulalongkorn University: 1998 	Roche, B., Roulleau, P., Jullien, T., Jompol, Y., Farrer, I., Ritchie, D.A., Glattli, D.C. Harvesting dissipated energy with a mesoscopic ratchet (2015) Nature Communications, 6, art. no. 6738
6	Ms. Dakrong Pissuwan	Asst Prof	<ul style="list-style-type: none"> Ph.D. Science (Nanobiotechnology), University of Technology Sydney, Australia: 2008 M.Sc. (Applied Microbiology), King Mongkut's University of 	Sukwong, P., Kongseng, S., Chaicherd, S., Yoovathaworn, K., Tubtimkuna, S., Pissuwan, D. Comparison effects of titanium dioxide



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No.	Name-Surname	Academic Position	Degree (field)/ Institute/ Graduation year	Most recent Academic Works in 5 years
			Technology Thonburi: 1999 B.Sc. (Microbiology), Srinakharinwirot University: 1994	nanoparticles on immune cells in adaptive and innate immune system (2017) IET Nanobiotechnology 11 (7), pp. 759-765.
7	Mr. Kittitat Subannajui	Assoc Prof	Ph.D. (Microsystem Engineering), Alber- Ludwig University of Freiburg, Germany: 2011 M.Sc. (Materials Science and Engineering) Christian Albrechts University of Kiel, Germany: 2006 B.Eng. (Metallurgical Engineering), Chulalongkorn university: 2002	Boonniyom, S., Osotchan, T., Subannajui, K. Hot embossing of anodic aluminium oxide on high-density polyethylene: A deeper understanding based on hard surface coating (2018) Micro and Nano Letters, 13 (3), pp. 357- 362.
8	Mr. Thammasit Vongsetskul	Assoc Prof	Ph.D. (Physical and Theoretical Chemistry) University of Oxford, UK : 2008 M.Sc. (Polymer) The Petroleum and Petrochemical College, Chulalongkorn university: 2004	Boriboon, D., Vongsetskul, T., Limthongkul, P., Kobsiriphat, W., Tammawat, P. Cellulose ultrafine fibers embedded with titania particles as a high performance and eco-



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No.	Name-Surname	Academic Position	Degree (field)/ Institute/ Graduation year	Most recent Academic Works in 5 years
			B.Sc. (Chemistry), Chulalongkorn university: 2002	friendly separator for lithium-ion batteries (2018) Carbohydrate Polymers, 189, pp. 145- 151.
9	Ms. Manthana Jariyaboon	Asst Prof	Ph.D. (Metallurgy and Materials), University of Birmingham, UK: 2006 M.Sc. (Analytical and Applied Inorganic Chemistry), Mahidol University: 2001 B.Sc. (Chemistry), Mahidol University: 1998	Rujeerapaiboon, N., Anuwongnukroh, N., Dechkunakorn, S., Jariyaboon, M. The effects of different bending techniques on corrosion resistance and nickel release of superelastic orthodontic NiTi archwires (2017) IOP Conference Series: Materials Science and Engineering, 191 (1), 012038.
10	Ms. Supa Wirasate	Asst Prof	Ph.D. (Chemical and Materials Engineering: Polymer major), University of Cincinnati, Ohio, USA: 2005 M.S. (Polymer) Petroleum and Petrochemical	Kosai, U., Wirasate, S. Preparation and properties of peroxide prevulcanized natural rubber/Ag nanocomposites: effect of AgNO ₃ adding sequence on mechanical and



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No.	Name-Surname	Academic Position	Degree (field)/ Institute/ Graduation year	Most recent Academic Works in 5 years
			College, Chulalongkorn University: 1996 B.Sc. (Materials Science), Chulalongkorn University: 1994	antimicrobial properties (2019) Composite Interfaces, 26 (3), pp. 233-246.
11	Mr. Toemsak Srihirin	Asst Prof	Ph.D.(Polymer Science and Engineering) Case Western Reserve University, USA.: 1998 B.Sc. (Chemistry), King Mongkut's University of Technology Thonburi: 1991	Juagwon, T., Lertvachirapaiboon, C., Shinbo, K., Kato, K., Srihirin, T., Osotchan, T., Baba, A. Detection of human immunoglobulin G by transmission surface plasmon resonance using the in situ gold nanoparticle growth method (2019) IEICE Transactions on Electronics, E102C(2), pp. 125-131.
12	Mr. Tanakorn Osotchan	Asst Prof	Ph.D. (Physics) Macquarie University, Australia: 1995 M.Sc. (Physics) Chulalongkorn University: 1989 B.Sc (Physics) Kasetsart University: 1986	Somdee, A., Osotchan, T. Effect of precipitating agent NaOH on the synthesis of SrTiO ₃ /TiO ₂ heterostructure for dye-sensitized solar cells (2019) Materials Chemistry and Physics, 229, pp. 210-214.



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No.	Name-Surname	Academic Position	Degree (field)/ Institute/ Graduation year	Most recent Academic Works in 5 years
13	Mr. Teerakiat Kerdcharoen	Asst Prof	Dr rer nat (Physical Chemistry) University of Innsbruck , Austria: 1995 M.Sc. (Physical Chemistry): Chulalongkorn University 1992 B.Sc. (Chemisty) Chulalongkorn University: 1989	Siyang, S., Nilpanapan, T., Kerdcharoen, T. Development of IoT-Based Data Shoes for Daily Life Step Count (2018) 2018 IEEE 7th Global Conference on Consumer Electronics, GCCE 2018, 8574793, pp. 442-446.

3.1.7 Full-time Instructors from other Faculties

None

3.1.8 Special Instructors

None

4. Components Related to Field Training Experience (Trainings or Multi-Activity Education) (If any)

4.1 Standard of Learning Outcome for Field Training Experience

- 4.1.1 Students gain experiences in materials science and nanoengineering through training and working in government research facilities and industrial plants
- 4.1.2 Students develop maturity and confident in making decisions
- 4.1.3 Students gain real working experiences
- 4.1.4 Students develop good relationship with co-workers

4.2 Duration

Not less than 16 weeks

4.3 Schedule and Timetable



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Year 4

4.4 Number of Credits

9 credits

4.5 Preparation

None

4.6 Evaluation Procedure

Evaluation from host organizations, presentation and reports

5. Requirements for Project or Research Work (If any)

5.1 Brief Description

Students are introduced to research project in materials science and nanoengineering or related fields under the close guidance of an advisor. Students are expected to independently carry out the learning process, employing their knowledge and technical skills, and implement the scientific process to address the research question of interest.

5.2 Standard of Learning Outcome

1. Understand concept and theory in materials science and nanoengineering
2. Apply knowledge and technical skills to address and solve problems in materials science and nanoengineering
3. Systematically analyze and conclude research using technical skills
4. Properly present research work

5.3 Duration

A semester

5.4 Number of Credits

9 credits

5.5 Preparation

In the orientation, each student will choose to do a research project from the topics offered by the Faculty of Science Division. They will receive information regarding the protocol to carry out this course, grading and evaluation scheme.

5.6 Evaluation Procedures



Students are expected to give oral presentation at the end of their project and hand in a research report.

Section 4 Program-level Learning Outcomes, Teaching Methods, and Evaluation

1. Development of Student Characteristics

Special Characteristics	Teaching Strategies and Student Activities
1. Have knowledge in materials science and can apply for solving problems in materials science and nanoengineering 2. Have expertise in using instruments and tools relating with materials science and nanoengineering 3. Can create works in the fields of materials science and nanoengineering	Different methods of formative and summative evaluation are used such as written and oral examination, practical test, oral presentation, individual or group class participation and project-based research learning. Rubrics based on the objectives of the course are announced clearly and used to score the students' achievement.

2. Relationship between PLOs and the professional standard or National Qualifications Framework for Higher Education / TQF (Shown in Appendix 3)

3. Program-level Learning Outcomes, Teaching Strategy, and Assessment

Program-level Learning Outcomes	Teaching Strategy	Assessment and Evaluation Strategy
PLO1 Solve industrial problems in the field of materials science and nanoengineering logically by applying interdisciplinary approaches.	Interactive lecture Case studies Group and individual discussions and feedback	Written exam Project
PLO2 Carry out industrial and academic works relating to materials science and nanoengineering by using appropriate instruments and in accordance with international	Laboratory Group and individual discussions and feedback	Report



Program-level Learning Outcomes	Teaching Strategy	Assessment and Evaluation Strategy
standard methodology.		
PLO3 Create an independent project in material science and nanoengineering analyzed from scientific journals and laboratory reports along with laboratory safety skills and professional code of conduct.	Group and individual discussions and feedback	Report Presentation
PLO4 Communicate concepts of material science and nano engineering clearly and purposefully with target audiences in English, in both written and oral forms with appropriate technologies in an organized manner.	Group and individual discussions and feedback	Report Presentation
PLO5 Work independently and coordinate with others to achieve team goals based on roles and responsibilities of a material scientist.	Laboratory Group and individual discussions and feedback	Report Presentation

Section 5 Student Evaluation Criteria

1. Grading Rules/Guidelines

Students receive grades according to the criteria stated in Mahidol University's regulations on undergraduate studies as well as SC's regulations and/or announcements.

(1) The symbols and their assigned scores

Grade results of each course may be shown in symbolic type as follows

Symbol	Meaning	Score
A	Excellent	4.00
B+	Very Good	3.50



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B	Good	3.00
C+	Fairly Good	2.50
C	Fair	2.00
D+	Poor	1.50
D	Very Poor	1.00
F	Failed	0.00

(2) The symbols without scores

The outcome of the study for each course may be in the forms of certain symbols with the meaning as follows

Symbol	Meaning
AU	Audit
O	Outstanding
S	Satisfactory
T	Transfer of Credit
U	Unsatisfactory
I	Incomplete
P	In Progress
X	No Report
W	Withdrawal

2. Standard Verification Process for Student Achievement

2.1 Analyze students' learning from class participation, group activities, presentations, quizzes and examinations.

2.2 Consider student evaluation of teachers

2.3 Consider course reports

2.4 Consider feedbacks from stakeholders including students, employers, alumni, and outside experts

3. Graduation Requirements



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Plan A

1. Following Mahidol University Regulations on Diploma and Undergraduate Studies, B.E. 2552 (2009) and the Announcement of Faculty of Science, Mahidol University on Undergraduate Study, B.E. 2553 (2010)
2. Total time of study should not exceed 8 academic years
3. Students must complete their credits as stated in the curriculum which includes:
 - General education courses
 - Specific courses
 - Free elective courses
4. Students must have a minimum 2.00 CUM-GPA
5. Students must pass the criteria set for the English competency prior to their graduation as specified by the Mahidol University's announcement.
6. Student must demonstrate proper conduct in compliance with the Bachelor of Science degree.

Plan B

1. Following Mahidol University Regulations on Diploma and Undergraduate Studies, B.E. 2552 (2009) and the Announcement of Faculty of Science, Mahidol University on Undergraduate Study, B.E. 2553 (2010)
2. Total time of study should not exceed 8 academic years
3. Students must complete their credits as stated in the curriculum which includes:
 - General education courses
 - Specific courses
 - Free elective courses
4. Students must pass evaluation by the standard of University of Technology Sydney* and have a minimum 2.00 CUM-GPA at the end of year 4 at Faculty of Science, Mahidol university
5. Student must demonstrate proper conduct in compliance with the Bachelor of Science degree.



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*See detail at UTS Legislation Rule and Policies

Note: Plan B students must pass the following requirements

1. Finish the first year of Program in Materials Science and Nanoengineering (International Program) with GPA higher than 2.5
2. Pass one of the following English Proficiency Test: IELTS 6.5 with written 6.0, TOEFL (internet base) 79-93 with written 6.0, AE5 Pass, PTE 58-64, CAE 58-66
3. Additional requirements complied with MOU between Faculty of Science, Mahidol University and University of Technology Sydney

4. Students' Appeals

According to Mahidol University Regulations on Disciplinary Measures 2010, the student, who is subject to disciplinary punishment, has the right to appeal to the procedures outlined here. In the case that student wishes to check on the scores, student can contact the instructor directly or submit formal complaint or academic appeal directly to

International Education And Administration Unit, Division of Salaya Campus
Room SC1-116, SC1-Building, Faculty of Science (Salaya Campus), Mahidol University
999 Phuttamonthon 4 Road, A. Phuttamonthon, Nakhon Pathom 73170, Thailand
E-mail: scsim@mahidol.ac.th; Phone: + 66 2 4419820 ext. 1199.

If it is considered that a case exists, the matter will be investigated in accordance with the procedures, and the complainant informed of the outcome



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Section 6 Instructor Professional Development

1. New Instructor Orientation

- 1) New instructors must attend an orientation that aims to provide objectives and goals of program complying with National Qualifications Framework for Higher Education in Thailand and the Standard of Undergraduate Programs of Study B.E. 2558 announced by the Ministry of Education.
- 2) New instructors will be made aware of teaching and learning strategies, quality assurance, and related regulation or announcement.

2. Knowledge and Skill Development for Instructor

2.1 Development of Teaching Skills, Assessment, and Evaluation

- 1) Provide workshops to develop skills on teaching and learning methods.
- 2) Allow instructors to participate in the evaluation and revision of the curriculum and courses as well as develop a new curriculum.

2.2 Other Academic and Professional Development

- 1) Support instructors to do research, produce and present academic projects and continue their studies.
- 2) Encourage and support instructors to attend meetings, training sessions, seminars and studies at other institutes and organizations.
- 3) Provide university's promotion standards

2.3 Indicators / Measurements

- (1) Every new instructor (if any) must participate in the orientation and receive adequate information on teaching and learning requirements.
- (2) Full-time instructors must demonstrate academic and/or profession improvement at least once a year.



Section 7 Quality Assurance

1. Quality Control

The curriculum has employed the Thai Qualification Framework for Higher Education and the Standard of Undergraduate Programs of Study B.E. 2558. The curriculum committee is set up to develop and improve the curriculum every 5 years based on stakeholders' requirement. Stakeholders are identified as academic faculty, current students, alumni, parents and employers. The curriculum committee also monitors the qualification of instructors. The curriculum committee meets on a regular basis to review stakeholder's inputs and evaluate courses. Once the curriculum (TQF2) has been approved, the curriculum structure is translated into course structures that have aligned objectives and learning outcomes. The details of the course structure have been documented in TQF3 and TQF4. The quality of the curriculum and courses is monitored throughout the period of implementation by the student and instructor self-evaluation through TQF7, TQF5 and 6 documents. Minor changes can be made in TQF3 to improve the teaching and learning.

Indicators/measurements used in the evaluation of this process's efficiency and effectiveness:

- (1) Use the TQF indicator guidelines
- (2) CHE-QA online

2. Graduates

Graduates achieve the learning areas including ethics and moral, knowledge, cognitive skills, interpersonal skills and responsibility, and numerical analysis, communication, and information technology skills. The survey is conducted to obtain feedback from employers on their satisfaction of the graduates. All the survey results are used to improve the quality of our teaching and learning.

Indicators/measurements used in the evaluation of this process's efficiency and effectiveness.

- (1) At least 70 percent of new graduates either go on to employment or further study.
- (2) The average graduate users' satisfaction score is at least 3.5 from 5.0.

3. Students



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3.1 Student recruitment and admission

Recruitment involves activities such as roadshows, open houses, campus visits, and public communication. Student admission criteria will be according to TCAS.

3.2 Academic consultation and guidance

Each student is assigned an academic advisor upon entering the program. The advisor's role is to oversee students' academic performance, approve their registration, and guide both the academic and non-academic matter.

3.3 Students' satisfaction and management of students' appeal

Students have a right to review their exam papers and grades. Moreover, if students are charged and/or punished for cheating, they can appeal within seven days after the time that they received such a notice. The procedure for filing a complaint is according to Mahidol University Regulations on Disciplinary Measures 2010.

Indicators/measurements used in the evaluation of this process's efficiency and effectiveness.

- (1) At least 70 percent of students remain in the program.
- (2) The average students' satisfaction score towards the courses' quality is at least 3.5 from 5.0.
- (3) At least 80 percent of final-year students graduate.

4. Instructors

4.1 Recruitment of new faculty members

General requirements are made according to Mahidol University and Faculty of Science regulations. New faculty members must pass a trial period of teaching before being accepted as full-time instructors. New instructors are required to participate in an orientation.

4.2 Instructor's main responsibility

Program committee and instructors are committed to meet at least once per semester to plan and improve teaching and learning methods according to student and self-evaluations. Faculty members are also encouraged to produce one academic product every three academic years as well as participate in conferences or training that may be beneficial to their profession.



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Indicators/measurements used in the evaluation of this process's efficiency and effectiveness.

- (1) Each instructor must produce TQF3 and TQF5 for all assigned courses.
- (2) Every new instructor (if any) has participated in the orientation or received advice on teaching and learning.
- (3) Every full-time instructor has been academically/professionally developed at least once a year.

5. Program, Teaching and Learning, Student Evaluation

The program description stated in TQF2 form complies with the Thai Qualifications Framework for Higher Education. Descriptions of all courses and field work sessions are stated in the TQF3 and TQF4 forms at least before the semesters begin. Students' achievement verification is made as stated in the TQF3 and TQF4 at least 20 percent of the subjects in each semester. The teaching and learning approaches for this curriculum follow an outcome-based education (OBE) strategy, based on the AUN-QA criteria. Teaching strategy and student's evaluation are developed/improved based on the information in the previous year's TQF7 reported within 60 days after the academic year ends.

Indicators/measurements used in the evaluation of this process's efficiency and effectiveness.

- (1) At the end of the semester, Instructors fill out TQF 4,5 to summarize the teaching process and to report any related issues. The information can serve as indicator to verify students' performance in each subject, and as record for improving subsequent offered courses.
- (2) Instructors and the program director will conduct the verification process as specified by TQF3 and TQF4 for at least one in every four courses (25%) offered in each academic year. This is to ensure the effectiveness of the curriculum.

6. Academic Supports

6.1 Budgeting



Mahidol University and Faculty of Science provides an annual budget for providing a suitable physical environment for studying and purchasing an adequate number of materials in order to support studying both inside and outside the classrooms.

6.2 Available resources

Students have access to papers, books, journals, teaching media, internet databases from the Mahidol University Library, Salaya Campus and the Faculty of Science Library (Stang Mongkolsuk Library). The Faculty of Science Library, also known as the Stang Mongkolsuk Library, houses a large collection of books and information on science and medical science. It also provides services in inter-library loan and retrieval of articles and databases on science and technology. There are about 35,000 books in chemistry and related fields as well as 1,200 printed journals. The Mahidol University Library, Salaya Campus, houses and collects books and information on science, medical sciences and technology to support teaching, learning, and research of university members, government officials, scientists, researchers and students of the university. The library services include books, journals, research reports, electronic journals, web databases, and also educational technology resources in the form of videotapes, recorded cassette tapes, slides and microfilms. Information technology (IT) facilities, including e-learning, are also available.

6.3 Studying the sufficiency of the resources

A survey of instructor and student satisfaction towards services and resources is carried out every semester. This survey is used to improve the number and quality of resources. If the resources are not adequate, the faculty committee will take into consideration and set action plan.

Indicators/measurements used in the evaluation of this process's efficiency and effectiveness.

- (1) The average staffs and students' satisfaction score towards the learning supports is at least 3.5 from 5.0



7. Key Performance Indicators

Key Performance Indicators	Academic Years				
	2019	2020	2021	2022	2023
(1) At least 80 percent of the instructors responsible for the program take part in meetings to plan, monitor, and revise the program's operation.	✓	✓	✓	✓	✓
(2) The program description stated in TQF2 form complies with TQFHE or the program TQF (if any).	✓	✓	✓	✓	✓
(3) Descriptions of all courses and field work sessions (if any) are stated in the TQF3 and TQF4 forms at least before the semesters begin.	✓	✓	✓	✓	✓
(4) The assessment of all courses and fieldwork sessions (if any) are reported in the TQF5 and TQF6 forms within 30 days after the semester ends.	✓	✓	✓	✓	✓
(5) The program report is made in the TQF7 form within 60 days after the academic year ends.	✓	✓	✓	✓	✓
(6) Students' achievement verification is made as stated in the TQF3 and TQF4 (if any) in at least 20 per cent of the subjects in each semester.	✓	✓	✓	✓	✓
(7) Teaching strategy and students evaluation are developed/ improved based on the information in the previous year's TQF7.		✓	✓	✓	✓
(8) Every new instructor (if any) has to participate in the orientation and receive adequate information on teaching and learning requirements.	✓	✓	✓	✓	✓
(9) Full-time instructors must demonstrate academic and/or profession improvement at least once a year.	✓	✓	✓	✓	✓



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Key Performance Indicators	Academic Years				
	2019	2020	2021	2022	2023
(10) At least 50 per cent of the teaching assistants (if any) receive academic or professional development annually.	✓	✓	✓	✓	✓
(11) The average final-year students' satisfaction score or the fresh graduates' satisfaction score towards the program's quality is at least 3.5 from 5.0.				✓	✓
(12) The average graduate users' satisfaction score is at least 3.5 from 5.0.					✓

Evaluation criteria: A curriculum that meets the standards of Thai Qualifications Framework must qualify for the following conditions: (1) the compulsory performance indicators (numbers 1-5) must pass beyond expectations and (2) the total number of performance indicators must reach their goal by no less than 80 percent each year.

Additional indicators from Section 7

Indicators and Goal	Academic Years				
	2019	2020	2021	2022	2023
2. Graduates					
2.1 At least 70 percent of new graduates either go on to employment or further study.					✓
3 Students					
3.1 At least 70 percent of students remain in the program.			✓	✓	✓
3.2 The average students' satisfaction score towards the courses' quality is at least 3.5 from 5.0.		✓	✓	✓	✓
3.3 Evaluation score of final-year student characteristics is at least 3.5 from 5.0.				✓	✓
3.4 At least 80 percent of final-year students graduate.				✓	✓



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Indicators and Goal	Academic Years				
	2019	2020	2021	2022	2023
3.5 Students graduate within average 5 years				✓	✓
4. Instructors					
4.1 Each instructor must produce TQF3 and TQF5 for all assigned courses.	✓	✓	✓	✓	✓
6. Academic Supports					
6.1 The average staffs and students' satisfaction score towards the learning supports is at least 3.5 from 5.0	✓	✓	✓	✓	✓



Section 8 Evaluation, Improvement, and Implementation of the Program

1. Assessment of Teaching Effectiveness

1.1 Assessment of Teaching Strategy

- Analyze from students' evaluation toward courses and instructors.
- Teaching observation by peer instructors.

1.2 Assessment of the Instructor's Skills in Applying Teaching Strategies

- Analyze from students' evaluation toward courses and instructors.
- Workshop on course improvement with the participation of all instructors in the courses

2. Overall Evaluation of the Program

- Survey on final-year students' satisfaction towards the program's quality
- Survey on employers' satisfaction with graduates
- Curriculum evaluation from external expertise

3. Assessment of the Program Implementation Based on the Program Specification

Evaluation is made annually by instructors and the curriculum committee according to key performance indicators of section 7, item 7.

4. Review of Evaluation Results and Plans for Improvement

Instructors in the program involved in revising, evaluating, and planning to improve and/or develop courses and the curriculum by analyzing results from students' evaluations of instructors; job availability of graduates; level of employers' satisfaction with graduates; and other evaluation results that relate to courses. In general, the curriculum committee has five-year cycle for curriculum change.



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Appendix shown in the TQF2
Revised program of academic year 2019

Appendix 1	Mahidol University Degree Profile
Appendix 2	2.1 Program-level Learning Outcomes (PLOs) and Sub Program-level Learning Outcomes (SubPLOs) 2.2 Relationship between Program-level Learning Outcomes and MU Graduate Attributes 2.3 Goals for each academic year for Bachelor of Science Program in Materials Science and Nano Engineering
Appendix 3	Table showing the comparison of the PLOs and the national TQF ➤ PLOs and TQF Level 2
Appendix 4	4.1 Curriculum Mapping <i>Shown with the symbols I, R, P, M, A</i>
Appendix 5	Major Improvements of the Bachelor of Science Program in 2016 (International Program) issued in Academic Year 2016
Appendix 6	Details of the instructors responsible for the program, regular instructors, and special instructors
Appendix 7	Mahidol University Regulations on Diploma and Undergraduate Studies of the Year B.E. 2560 and the affiliation's educational announcements/regulations
Appendix 8	Order of Curriculum Development Committee or Curriculum Screening Procedure Committee or Person In-charge
Appendix 9	MOUs Made between Mahidol University and University of Technology Sydney
Other Appendixes	



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Appendix 1

Mahidol University Degree Profile



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Mahidol University Degree Profile

Bachelor's Degree Program	
1. Program Title	
(In Thai)	หลักสูตรวิทยาศาสตรบัณฑิต สาขาวิชาวัสดุศาสตร์และวิศวกรรมนาโน (หลักสูตรนานาชาติ)
(In English)	Bachelor of Science Program in Materials Science and Nano Engineering (International Program)
2. Degree Offered	
(In Thai)	วิทยาศาสตรบัณฑิต (วัสดุศาสตร์และวิศวกรรมนาโน)
(In English)	Bachelor of Science (Materials Science and Nano Engineering)
General information of the program	
Type of program	Bachelor's Degree (International Program), Academic Program
Total credits required	Plan A - no less than 133 credits of courses taken while studying at Faculty of Science, Mahidol University (MUSC). Plan B - no less than 83 credits of courses taken while studying at Faculty of Science, Mahidol University (MUSC) no less than 96 credits taken while studying at University of Technology Sydney (equivalent to 53 Mahidol credits)
Studying duration / Program cycle	4-Year Program
The program's status and opening schedule	1. Revised Program 2019 2. Program start: Semester I Academic Year 2019
Degree offered	One degree of one major
Degree-granting Institutions (MOU with other institutions)	Mahidol University, Thailand
Organization certifying the standards	-



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Specific information of the program

Purpose / Goals / Objectives

Goals

To educate and provide certified bachelor-degree for graduates, who meet the specific requirements of the science-based National Qualifications Framework, with the insightful understanding of theories and applications of materials science and Nano engineering frontier together with innovation perspectives. The graduates will be able to possess four MU graduated attributes (i.e., T-shaped (having knowledge in breadth and depth, globally talented, socially contributing, and entrepreneurially minded), which make them well-qualified for the employment in highly competitive organizations.

Objectives

To produce graduates who have the characteristics, knowledge and skills as follows:

1. integrate and apply knowledge in materials science, nanoscale science, technology, and related sciences to address current and future industrial needs.
2. demonstrate technical skills for using instruments and planning and development of projects involved in manufacturing and service industries.



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Distinctive features	<ol style="list-style-type: none"> 1. This program is designed to develop students via learning by doing approach. Students will join world-class research laboratories from a second year onward. Students will have 1 full semester to carry out advanced research project and 1 full semester for industrial internship. This process will develop various skills for students including hand-on experience with various instruments, problem solving, creative thinking and innovation and team work. 2. This program also provides opportunity for students to have working/studying experience abroad through doubled degree with University of Technology of Sydney
Educational system	Semester System
Graduates' advancement	
Career opportunities	<ol style="list-style-type: none"> 1. Most graduates go into a range of employment in leading industries such as oil and gas, automotive, manufacturing, pharmaceuticals, jewelry, ceramics, glass, paints, polymers, metals, etc. 2. Jobs are available in many sectors such product/process development scientist, materials engineer, manufacturing system engineer, quality manager, project manager, technical sale engineer, etc. 3. Graduates can work as research assistant in leading
Further fields of study	Continue their studies for higher degree in electrical, chemical and materials engineering, materials science, and related fields such as polymer and chemistry.



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Educational philosophy in program management	
Program philosophy	<p>Our primary focus is on educating the learners, as for them to attain academic achievement through learning-centered education, outcome-based education and constructivism.</p> <p>To become a wisdom graduate, learners combine what they have learned so far with the new knowledge, and with experiential learning activities. While the role of a lecturer in the learning process is shift from an information provider to a coach or a facilitator creating challenge-</p>
Strategy / teaching guidelines	<p>The program is aware of student differences in backgrounds, strengths and weaknesses, interests, and learning styles. Therefore, a range of teaching styles are set through the diverse learning activities according to the learning outcomes including interactive lectures, laboratory practical, individual and group discussions and assignments, active research projects with emphasis on student's demonstration of ideas, logical reasoning, and</p>
Strategy / student's evaluation guidelines	<p>The assessments and evaluations align with the teaching strategies and the desired learning outcomes such as written and oral examination, practical test, oral presentation, individual or group class participation and project-based research learning. Rubrics based on the objectives of the course are announced clearly and used to score the students' achievement.</p>



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Competences provided to the students	
Generic Competences	<ol style="list-style-type: none"> 1. Ethics: demonstrate moral and ethical behavior and be responsible in their own action including awareness of plagiarism 2. Critical thinking and analysis: be capable of analytical and critical thinking and be able to evaluate both general and scientific information with logical and systematic thinking 3. Creativity: be able to bridge research to innovation which further enhance basic knowledge. 4. Communication: be able to choose appropriate forms of English communication such as listening, speaking, reading and writing skills, depending on target audience and for academic purposes 5. Collaboration: be able to work with others appropriately and accept the difference between people 6. ICT: be able to choose the appropriate information technology for searching of information and data and be able to analyze the reliability of data from various sources
Subject-specific Competences	<ol style="list-style-type: none"> 1. Conceptual knowledge in basic science including biology, chemistry, mathematics, and physics. 2. Conceptual knowledge in materials science and Nano engineering including classes of materials and the relationship between the scale and the properties of materials. 3. Experience in a wide range of laboratories with laboratory techniques and scientific instruments in materials science and Nano engineering.



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Graduates' learning Outcomes	
PLO1	Solve industrial problems in the field of materials science and nanoengineering logically by applying interdisciplinary approaches.
PLO2	Carry out industrial and academic works relating to materials science and nanoengineering by using appropriate instruments and in accordance with international standard
PLO3	Create an independent project in material science and nanoengineering analyzed from scientific journals and laboratory reports along with laboratory safety skills and professional code of conduct.
PLO4	Communicate concepts of material science and nano engineering clearly and purposefully with target audiences in English, in both written and oral forms with appropriate technologies in an organized manner.
PLO5	Work independently and coordinate with others to achieve team goals based on roles and responsibilities of a material scientist.



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Appendix

1. Requirements: Qualifications of lecturers in charge of the program

Name-Surname	Educational Qualifications	Latest Academic Products in the Past 5 Years
Asst. Prof. Dr. Rakchart Traiphol	-Ph.D. (Chemistry), Clemson University, USA: 2003 - B.Sc. (Chemistry), Khonkaen University: 1996	Potai, R., Faisadcha, K., Traiphol, R., Traiphol, N. Controllable thermochromic and phase transition behaviors of polydiacetylene/zinc(II) ion/zinc oxide nanocomposites via photopolymerization: An insight into the molecular level (2018) Colloids and Surfaces A: Physicochemical and Engineering Aspects, 555, pp. 27-36.
Asst. Prof. Dr. Chayanisa Chitichotpanya	-Ph.D. (Materials Science and Engineering), University of Rochester, USA: 2004 -M.Sc.(Materials Science and Engineering), University of Rochester, USA: 1997 - B.Sc. (Chemistry), Chulalongkorn University: 1992	Chitichotpanya, P., Pisitsak, P., Chitichotpanya, C. Sericin-copper-functionalized silk fabrics for enhanced ultraviolet protection and antibacterial properties using response surface methodology (2018) Textile Research Journal, 89, pp. 1166-1179.
Dr. Pongsakorn Kanjanaboos	-MS-PHD. (Physics), University of Chicago, USA (2013) -BA (Physics and Economics), Washington University in Saint Louis, USA (2008)	Boonthum, C., Pinsuwan, K., Ponchai, J., Srihirin, T., Kanjanaboos, P. Reconditioning perovskite films in vapor environments through repeated cation doping (2018) Applied Physics Express, 11 (6), art. no.



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Dr. Tanant Waritanant	- Ph.D. (Engineering), University of Manitoba, Canada: 2017 - M.Sc. (Optics and Photonics), National Central University, Taiwan: 2011 - B. Eng. (Electronic) Chulalongkorn University: 2009	Nadimi, M., Waritanant, T., Major, A. Thermal lensing in Nd:GdVO ₄ laser with direct in-band pumping at 912 nm (2018) Applied Physics B: Lasers and Optics, 124 (8), 170.
Dr. Yodchay Jompol	-Ph.D. in Physics, University of Cambridge, UK: 2008 -M.Sc. in Physics, Chalmers University of Technology, Sweden: 2001 - B.Sc. (Physics), Chulalongkorn University: 1998	Roche, B., Roulleau, P., Jullien, T., Jompol, Y., Farrer, I., Ritchie, D.A., Glattli, D.C. Harvesting dissipated energy with a mesoscopic ratchet (2015) Nature Communications, 6, art. no. 6738



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Appendix 2

2.1 Program-level Learning Outcomes and Sub Program-level Learning Outcomes
(PLOs and SubPLOs)

2.2 Relationship between Program-Learning Outcomes and MU Graduate Attributes

2.3 Goals for each academic year for Bachelor of Science Program in Materials
Science and Nano Engineering



**2.1 Program-level Learning Outcomes and Sub Program-level Learning Outcomes
 (PLOs and SubPLOs)**

Table in Appendix 2.1 Program-level Learning Outcomes (PLOs) and Sub Program-level Learning Outcomes (SubPLOs)

PLOs	SubPLOs
PLO1 Solve industrial problems in the field of materials science and nanoengineering logically and systematically by applying interdisciplinary approaches.	1.1 Use knowledge in basic mathematic, physic, chemistry, biology, and engineering to solve problems in materials science and nanoengineering. 1.2 Capable of acquiring knowledge from literatures and/or other sources to solve problems in assigned job with a reasonable procedure.
PLO2 Carry out industrial and/or academic works relating to materials science and nanoengineering by using appropriate instruments and in accordance with international standard methodology.	2.1 Understand the function of instruments and use them properly in the laboratories or industries. 2.2 Capable of learning and operating instruments available in laboratories or industries.
PLO3 Create an independent project in material science and nanoengineering analyzed from scientific journals and laboratory reports along with laboratory safety skills and professional code of conduct.	3.1 Make scientific hypothesis, designing, analyzing, and discussing materials science and nanoengineering projects. 3.2 Capable of creating materials science and nanoengineering research project and/or works.
PLO4 Communicate concepts of material science and nano engineering clearly and purposefully with target audiences in English, in both written and oral forms with appropriate technologies in an organized manner.	4.1 Skillful in the communication of general materials science and nanoengineering concepts in English. 4.2 Being able to discuss using a suitable, understandable, and punctual method to enhance the reliability when working with specialists or other non-scientists.



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PLOs	SubPLOs
PLO5 Work independently and coordinate with others to achieve team goals based on roles and responsibilities of a material scientist.	5.1 Perform a leadership and other roles in a proper manner and situation. 5.2 Work as a team and be responsible to the organization and society.

2.2 Relationship between Program-Learning Outcomes and MU Graduate Attributes

Table in Appendix 2.2 Relationship between Program Learning Outcomes & MU Graduate Attributes

Program Learning Outcomes / 4 Graduate Attributes	PLO1	PLO2	PLO3	PLO4	PLO5
T-shaped Breadth & Depth – Understanding thoroughly both breadth & depth	✓		✓	✓	✓
Globally Talented – Having talented and experiences to contending against globally			✓		✓
Socially Contributing - Having a public consciousness advantaging to the society	✓	✓		✓	
Entrepreneurially Minded – Decisively thinking, doing, making a decision to accordingly contributing creativity		✓			✓



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2.3 Goals for each academic year for Bachelor of Science Program in Materials Science and Nano Engineering

Table in Appendix 2.3 Goals for each academic year for Bachelor of Science Program in Materials Science and Nano Engineering

Goals for each academic year				Program Learning Outcomes
at the end of year 1	at the end of year 2	at the end of year 3	at the end of year 4	
Students know the basic sciences.	Students know the basic concepts of materials.	Students can solve basic materials science problems.	Students can solve materials science problems utilizing interdisciplinary approaches.	PLO1 Solve industrial problems in the field of materials science and nanoengineering logically by applying interdisciplinary approaches
Students know the basic sciences.	Students know the basic concepts of materials.	Students can solve basic materials science problems.	Students accustom to the working principle in organizations.	PLO2 Carry out industrial and academic works relating to materials science and nanoengineering by using appropriate instruments and in accordance with international



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Goals for each academic year				Program Learning Outcomes
at the end of year 1	at the end of year 2	at the end of year 3	at the end of year 4	
				standard methodology
	Students know the basic concepts of materials.	Students can carry on an assigned research project.	Students can create and conduct their own project.	PLO3 Create an independent project in material science and nanoengineering analyzed from scientific journals and laboratory reports along with laboratory safety skills and professional code of conduct
Students understand basic science classes taught in English.	Students understand materials science classes taught in English.	Student can effectively use English in reports and presentations.	Student can discuss about materials science in english.	PLO4 Communicate concepts of material science and nano engineering clearly and purposefully with target audiences in English, in both written and oral forms with appropriate



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Goals for each academic year				Program Learning Outcomes
at the end of year 1	at the end of year 2	at the end of year 3	at the end of year 4	
				technologies in an organized manner
Students can work independently on basic science problems.	Students can work independently on materials science problems.	Students can work independently and coordinate with others on materials science problems.	Students can work independently and coordinate with others to create materials science projects.	PLO5 Work independently and coordinate with others to achieve team goals based on roles and responsibilities of a material scientist



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Appendix 3

Table showing the comparison between the PLOs and the national TQF



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Table in Appendix 3 Relationship Between Program-Level Learning Outcomes (PLOs) and TQF

TQF Level 2 Competencies / Skills / Los	PL01	PL02	PL03	PL04	PL05
Competency / skill 1 : Moral <i>(Ethics and Moral)</i>					
1.1 Have honesty and integrity	✓		✓		
1.2 Have self-discipline		✓			✓
1.3 Have awareness and realize in compliance with academic and professional ethics	✓		✓		
1.4 Respect rights and opinion of other people					✓
1.5 Have public mind					✓
Competency / skill 2 : Knowledge					
2.1 Have knowledge on principles and theories of science and/or mathematics	✓	✓	✓		
2.2 Have basic knowledge on science and mathematics that can be used to explain principles and theories in specific field	✓		✓	✓	
2.3 Be able to catch up academic advancement and development of new knowledge especially in science and mathematics	✓		✓		
2.4 Possess broad knowledge in various fields that can be applied in daily life	✓		✓	✓	
Competency / skill 3 : Cognitive					
3.1 Be able to systematically and reasonably analyze based on scientific principles and methods	✓	✓	✓		
3.2 Correctly and appropriately apply scientific and mathematical knowledge in various situation	✓		✓		



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TQF Level 2 Competencies / Skills / Los	PL01	PL02	PL03	PL04	PL05
3.3 Have desire for knowledge, be able to correctly analyze and synthesize knowledge from various sources of data that will lead to creating innovation	✓	✓	✓		
Competency / skill 4 : Communication (Interpersonal Skills and Responsibility)					
4.1 Have leadership and be able to work with other people as a good leader and a good team member		✓			✓
4.2 Have responsibility for society and organization as well as self-development and work development	✓				✓
4.3 Be able to adapt self to organizational situation and culture					✓
Competency / skill 5 : ICT (Numerical Analysis, Communication and Information Technology)					
5.1 Be able to apply mathematical and statistical knowledge to appropriately analyze, process, solve problem and present information	✓			✓	
5.2 Possess language skills to effectively communicate knowledge on science and mathematics as well as be able to select appropriate forms of communication					✓
5.3 Possess skills and knowledge on English or other foreign language that are suitable and necessary for doing research			✓	✓	



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TQF Level 2 Competencies / Skills / Los	PL01	PL02	PL03	PL04	PL05
5.4 Be able to apply information technology on searching and collecting data that is effective and suitable for the situation			✓	✓	
Competency / skill 6 : Psychomotor 6.1 Possess skills of coordinated activity involving physical skill, which demonstrate use of precision instruments or tools		✓			



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Appendix 4 Curriculum Mapping



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Table in Appendix 4.1 Curriculum Mapping

Plan A

Course Codes and Titles		Number of credits	Program Learning Outcomes (PLOs)				
			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
Bachelor of Science Program in Materials Science and Nanoengineering							
Year 1							
วจปส ๑๐๑ PRPR 101	ประชากรและการพัฒนา Population and Development	2 (2-0-4)	I	I			
ศศกอ ๑๘๐ LAEN 180	ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ๑ English for Academic Purpose I	2 (2-0-4)	I	I		I	
วทคณ ๑๗๔ SCMA 174	แคลคูลัสและระบบสมการเชิงอนุพันธ์สามัญ Calculus and System of Ordinary Differential Equations	3 (3-0-6)	I	I	I		
วทคร ๑๐๓ SCID 103	เทคโนโลยีสารสนเทศในชีวิตประจำวัน Information Technology in Daily Life	3 (3-0-6)	I	I	I	I	
วทคม ๑๘๙ SCCH 189	ปฏิบัติการเคมี Chemistry Laboratory	1 (0-3-1)	I	P	I	I	I
วทคม ๑๖๑ SCCH 161	เคมีทั่วไป General Chemistry	3 (3-0-6)	I	I	I		
วทฟส ๑๑๑ SCPY 111	ปฏิบัติการฟิสิกส์ขั้นพื้นฐาน Basic Physics Laboratory	1 (0-3-1)	I	P	I	I	I
วทฟส ๑๘๐	ฟิสิกส์ทั่วไป	3 (3-0-6)	I	I	I		



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Course Codes and Titles		Number of credits	Program Learning Outcomes (PLOs)				
			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
SCPY 180	General Physics						
วททส ๑๐๑ SCBE 101	ชีววิทยาทั่วไป ๑ General Biology 1	3 (3-0-6)	I	I	I		
วททส ๑๐๒ SCBE 102	ปฏิบัติการชีววิทยาทั่วไป ๑ General Biology Laboratory 1	1 (0-3-1)	I	P	I	I	I
ศศกอ ๒๘๒ LAEN 282	พหุภาษาและพหุวัฒนธรรม Multilingualism and Multiculturalism	2 (2-0-4)	I	I		I	I
สวศท ๑๐๕ ENGE 105	บูรณาการสุขภาพและสิ่งแวดล้อม Integrated Health and Environment	3 (3-0-6)	I	I		I	
ศศกอ ๑๘๑ LAEN 181	ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ ๒ English for Academic Purpose II	2 (2-0-4)	I	I		I	
วทชพ ๑๒๑ SCBM 121	ชีววิทยาระดับเซลล์และโมเลกุล Cell and Molecular Biology	2 (2-0-4)	I	I	I		
วจปส ๑๐๑ PRPR 101	ประชากรและการพัฒนา Population and Development	2 (2-0-4)	I	I			
วทนว ๓๐๕ SCIN 305	ทักษะสำคัญสำหรับการวิจัยทางวิทยาศาสตร์ Essential Skills for Scientific Research	1 (1-0-2)	I	I	I	I	I
วศอก ๑๙๕	ปฏิบัติการวิศวกรรมพื้นฐาน	3 (2-2-5)	I	P	I	I	I



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Course Codes and Titles		Number of credits	Program Learning Outcomes (PLOs)				
			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
EGIE 195	Basic Engineering Workshops						
วทวน ๓๗๒ SCME 372	วิทยาศาสตร์และนวัตกรรม Scientific Creativity and Innovation	3 (3-0-6)					
วทวน ๑๐๑ SCME 101	หลักการขั้นแนะนำทางวัสดุศาสตร์ Introduction to Materials	3 (3-0-6)					
Bachelor of Science Program in Materials Science and Nanoengineering							
Year 2							
วทวน ๑๓๐ SCME 130	วิทยาศาสตร์และเทคโนโลยีด้านพลังงาน Energy Sciences and Technology	3 (3-0-6)					
วทวน ๑๐๑ SCIN 101	การคิดสร้างสรรค์และนวัตกรรม Creative Thinking and Innovation	2 (2-0-4)					
วทส ๑๕๒ SCBE 152	นิทัศน์ทางวิทยาศาสตร์ ธรรมชาติNatural Science Illustration	3 (1-4-4)					
วทส ๒๕๕ SCBE 255	สุนทรียศาสตร์ของกลิ่นและรส Aesthetics of Fragrance and Flavor	3 (2-3-5)				R	
วทวน ๒๓๑ SCME 231	โมเดิร์นฟิสิกส์และกลศาสตร์ควอนตัม	3 (3-0-6)				R	



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Course Codes and Titles		Number of credits	Program Learning Outcomes (PLOs)				
			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
	Modern Physics and Quantum Mechanics						
วทวน ๒๒๒ SCME 222	เคมีเชิงฟิสิกส์และอุณหพลศาสตร์ Physical Chemistry and Thermodynamics	3 (3-0-6)	I	I	I	R	R
วทวน ๒๖๔ SCME 264	วัสดุนาโนและการประยุกต์ Nanomaterials and Applications	3 (3-0-6)	R	I	I	R	I
วทวน ๒๖๓ SCME 263	นาโนเทคโนโลยีทางชีวภาพ Nanobiotechnology	3 (3-0-6)	R	I	I	R	I
วทวน ๒๐๒ SCME 202	หลักการของเซรามิก Principle of Ceramics	3 (3-0-6)	R	I	I	R	I
วทวน ๒๐๓ SCME 203	กายภาพของโลหะ Physical Metallurgy	3 (3-0-6)	R	I	I	R	I
วทวน ๒๑๑ SCME 211	การโปรแกรมคอมพิวเตอร์และการจำลอง Computer Programing and Simulation	3 (3-0-6)	I	R	R	R	I
วทคณ ๒๕๙ SCMA 259	พีชคณิตเชิงเส้น Linear Algebra	3 (3-0-6)	R	R			R
วศอก ๒๙๕ EGIE 295	กลศาสตร์สำหรับวิศวกรวัสดุ Mechanics for Materials Engineers	3 (3-0-6)	R	R	P		R
วทวน ๒๘๒ SCME 282	โครงการนวัตกรรมวัสดุ ๑ Materials Innovation Project I	1 (0-3-1)	R	R	P	R	P



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			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
วทวน ๒๘๓ SCME 283	โครงการนวัตกรรมวัสดุ ๒ Materials Innovation Project II	1 (0-3-1)	R	R	P	R	P
วทวน ๓๓๐ SCME 330	ฟิสิกส์สถานะแข็งสำหรับวัสดุ ศาสตร์ Solid-State Physics for Materials Science	3 (3-0-6)	R	I	I		I
วทวน ๓๖๑ SCME 361	สารกึ่งตัวนำและนาโน อิเล็กทรอนิกส์ Semiconductor and Nano Electronics	3 (3-0-6)	R	I	I		I
วทวน ๓๗๓ SCME 373	วัสดุศาสตร์และวิศวกรรมนาโน ในระบบโรงงานอุตสาหกรรม Materials Science and Nano Engineering in Industrial Process	3 (3-0-6)	R	I	I	P	I
วทวน ๓๒๑ SCME 321	วิทยาศาสตร์พอลิเมอร์และการ ขึ้นรูป Principle of Polymer Science and Processing	3 (3-0-6)	R	R	P	P	P
วทวน ๓๘๖ SCME 386	สัมมนาวัสดุศาสตร์และ วิศวกรรมนาโน Seminar in Materials Science and Nano Engineering	1 (0-3-1)	I	R	R	M	R
Bachelor of Science Program in Materials Science and Nanoengineering							
Year 3							



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			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
วทวน ๓๓๐ SCME 330	ฟิสิกส์สถานะแข็งสำหรับวัสดุศาสตร์ Solid-State Physics for Materials Science	3 (3-0-6)	R	I	I		I
วทวน ๓๖๑ SCME 361	สารกึ่งตัวนำและนาโนอิเล็กทรอนิกส์ Semiconductor and Nano Electronics	3 (3-0-6)	R	I	I		I
วทวน ๓๗๓ SCME 373	วัสดุศาสตร์และวิศวกรรมนาโนในระบบโรงงานอุตสาหกรรม Materials Science and Nano Engineering in Industrial Process	3 (3-0-6)	R	I	I	P	I
วทวน ๓๒๑ SCME 321	วิทยาศาสตร์พอลิเมอร์และการขึ้นรูป Principle of Polymer Science and Processing	3 (3-0-6)	R	R	P	P	P
วทวน ๓๘๖ SCME 386	สัมมนาวัสดุศาสตร์และวิศวกรรมนาโน Seminar in Materials Science and Nano Engineering	1 (0-3-1)	I	R	R	M	R
วทวน ๓๐๑ SCME 301	การใช้เครื่องมือสำหรับวัสดุศาสตร์และวิศวกรรมนาโน Instrumental Methods for Materials Science and Nano Engineering	3 (3-0-6)	M	R	R	P	R



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Course Codes and Titles		Number of credits	Program Learning Outcomes (PLOs)				
			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
วทวน ๓๘๑ SCME 381	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์ และวิศวกรรมนาโน ๑ Research Laboratory in Materials Science and Nano Engineering I	1 (0-3-1)	M	R	P	P	R
วทวน ๓๘๒ SCME 382	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์ และวิศวกรรมนาโน ๒ Research Laboratory in Materials Science and Nano Engineering II	1 (0-3-1)	M	R	P	P	R
	วิชาเลือกในกลุ่มวิชาวัสดุศาสตร์ และวิศวกรรมนาโน Major Elective	8					
	วิชาเลือกเสรี Free Elective	6					
Bachelor of Science Program in Materials Science and Nanoengineering							
Year 4							
วทวน ๔๘๖ SCME 486	โครงการวิจัยวัสดุศาสตร์ Materials Science Research Project	9 (0-27-9)	M	M/A	M/P	M	M/A
	วิชาเลือกในกลุ่มวิชาวัสดุศาสตร์ และวิศวกรรมนาโน Major Elective	9					



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Plan B

Course Codes and Titles		Number of credits	Program Learning Outcomes (PLOs)				
			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
Bachelor of Science Program in Materials Science and Nanoengineering							
Year 1 (at Mahidol University)							
วจปส ๑๐๑ PRPR 101	ประชากรและการพัฒนา Population and Development	2 (2-0-4)	I	I			
ศศกอ ๑๘๐ LAEN 180	ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ ๑ English for Academic Purpose I	2 (2-0-4)	I	I		I	
วทคณ ๑๗๔ SCMA 174	แคลคูลัสและระบบสมการเชิงอนุพันธ์สามัญ Calculus and System of Ordinary Differential Equations	3 (3-0-6)	I	I	I		
วทคร ๑๐๓ SCID 103	เทคโนโลยีสารสนเทศในชีวิตประจำวัน Information Technology in Daily Life	3 (3-0-6)	I	I	I	I	
วทคม ๑๘๙ SCCH 189	ปฏิบัติการเคมี Chemistry Laboratory	1 (0-3-1)	I	P	I	I	I
วทคม ๑๖๑ SCCH 161	เคมีทั่วไป General Chemistry	3 (3-0-6)	I	I	I		
วทฟส ๑๑๑ SCPY 111	ปฏิบัติการฟิสิกส์ขั้นพื้นฐาน Basic Physics Laboratory	1 (0-3-1)	I	P	I	I	I



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Course Codes and Titles		Number of credits	Program Learning Outcomes (PLOs)				
			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
วทฟส ๑๘๐ SCPY 180	ฟิสิกส์ทั่วไป General Physics	3 (3-0-6)	I	I	I		
วททส ๑๐๑ SCBE 101	ชีววิทยาทั่วไป ๑ General Biology 1	3 (3-0-6)	I	I	I		
วททส ๑๐๒ SCBE 102	ปฏิบัติการชีววิทยาทั่วไป ๑ General Biology Laboratory 1	1 (0-3-1)	I	P	I	I	I
ศศภอ ๒๘๒ LAEN 282	พหุภาษาและพหุวัฒนธรรม Multilingualism and Multiculturalism	2 (2-0-4)	I	I		I	I
สวศท ๑๐๕ ENGE 105	บูรณาการสุขภาพและสิ่งแวดล้อม Integrated Health and Environment	3 (3-0-6)	I	I		I	
ศศภอ ๑๘๑ LAEN 181	ภาษาอังกฤษเพื่อวัตถุประสงค์ทางวิชาการ ๒ English for Academic Purpose II	2 (2-0-4)	I	I		I	
วทขพ ๑๒๑ SCBM 121	ชีววิทยาระดับเซลล์และโมเลกุล Cell and Molecular Biology	2 (2-0-4)	I	I	I		
วจปส ๑๐๑ PRPR 101	ประชากรและการพัฒนา Population and Development	2 (2-0-4)	I	I			
วทนว ๓๐๕ SCIN 305	ทักษะสำคัญสำหรับการวิจัยทางวิทยาศาสตร์ Essential Skills for Scientific Research	1 (1-0-2)	I	I	I	I	I
วศอก ๑๙๕	ปฏิบัติการวิศวกรรมพื้นฐาน	3 (2-2-5)	I	P	I	I	I



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Course Codes and Titles		Number of credits	Program Learning Outcomes (PLOs)				
			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
EGIE 195	Basic Engineering Workshops						
วทวน ๓๗๒ SCME 372	วิทยาศาสตร์และนวัตกรรม Scientific Creativity and Innovation	3 (3-0-6)	I	I	I	I	I
วทวน ๑๐๑ SCME 101	หลักการขั้นแนะนำทางวัสดุ ศาสตร์ Introduction to Materials	3 (3-0-6)	I	I	I	I	I
Bachelor of Science Program in Materials Science and Nanoengineering							
Year 2 Spring semester (Semester 1 at UTS)							
33130	Mathematical Modeling I	6	I	I	I		R
68201	Physics in Action	6	R	I	R		I
65212	Chemistry 2	6	R	I	I		R
33230	Mathematical Modeling II	6	R	I	I		R
Bachelor of Science Program in Materials Science and Nanoengineering							
Year 2 Autumn Semester (Semester 2 at UTS)							
33360	Mathematics for Physical Science	6	R	R	I		I
65307	Physical Chemistry I	6	I	I	I		I
68412	Energy Science & Technology	6	R	R	I		R
68075	Nanomaterials	6	R	I	R		R
Bachelor of Science Program in Materials Science and Nanoengineering							
Year 3 Spring semester (Semester 1 at UTS)							
91140 or 68320	Bionanotechnology Scanning Probe and Electron Microscopy	6	R	R	R		R
68513	Nanophotonics	6	R	P	M		P



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Course Codes and Titles		Number of credits	Program Learning Outcomes (PLOs)				
			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
68413	Quantum Physics	6	R	P	R		P
68206	Optics	6	R	R	R		P
Bachelor of Science Program in Materials Science and Nanoengineering							
Year 3 Autumn semester (Semester 2 at UTS)							
68316	Applied Electronics and Interfacing	6	R	P	P		P
67509	Molecular Nanotechnology	6	R	P	M		P
68606	Solid-state Science and Nanodevices	6	R	R	M		R
68416	Computational Physics	6	R	R	P		R
Bachelor of Science Program in Materials Science and Nanoengineering							
Year 4 (at Mahidol University)							
วทวน ๔๘๖ SCME 486	โครงการวิจัยด้านวัสดุศาสตร์ Materials Science Research Project	9 (0-27-9)	M	M/A	M/P	M	M/A
วทวน ๓๐๑ SCME 301	การใช้เครื่องมือสำหรับวัสดุศาสตร์และวิศวกรรมนาโน Instrumental Methods for Materials Science and Nano Engineering	3 (3-0-6)	M	R	R	P	R
วทวน ๓๒๑ SCME 321	วิทยาศาสตร์พอลิเมอร์และกระบวนการผลิต Principle of Polymer Science and Processing	3 (3-0-6)	R	R	R	P	P
วทวน ๓๘๑ SCME 381	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์และวิศวกรรมนาโน ๑	1 (0-3-1)	M	R	P	P	R



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Course Codes and Titles		Number of credits	Program Learning Outcomes (PLOs)				
			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5
	Research Laboratory in Materials Science and Nano Engineering I						
วทวน ๒๘๒ SCME 282	โครงการนวัตกรรมวัสดุ ๑ Materials Innovation Project I	1 (0-3-1)	R	R	P	R	P
วทวน ๑๐๑ SCIN 101	การคิดสร้างสรรค์และนวัตกรรม Creative thinking & Innovation	2 (2-0-4)	I	I	I	I	I
วศอก ๒๙๕ EGIE 295	กลศาสตร์สำหรับวิศวกรวัสดุ Mechanics for Materials Engineers	3 (3-0-6)	R	R	P		R

I : PLO is Introduced and Assessed

R : PLO is Reinforced and Assessed

P : PLO is Practiced and Assessed

M : Level of Mastery is Assessed

A : Assessment



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Appendix 5

Major Improvements of the Bachelor of Science Program in Materials Science and
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**Program under Revision Bachelor of Science Program in Materials Science and
Nanoengineering (International Program) Academic Year 2016
Faculty of Science, Mahidol University**

1. This program has been approved by the Office of the Higher Education Commission on
.....
2. The Mahidol University Council has approved this revision in its meeting no 11/2016 on 13
July 2016
3. The revised program is to be implemented starting in the academic year of 2019
from semester 1 of the year 2019 onwards.
4. Reasons for the revision
 - 4.1 To emphasize outcome-based education and to meet AUN-QA standard
 - 4.2 To adopt latest changes in the discipline
 - 4.3 To adapt course offerings to modern educational standards and demand.
 - 4.4 To meet the challenges of living and working in a diverse and globalized world.

5. Content of the Revision

5.1 Add new core courses to the program

วทวน ๒๘๒	โครงการนวัตกรรมวัสดุ ๑	1 (0-3-1)
SCME 282	Materials Innovation Project I	
วทวน ๒๘๓	โครงการนวัตกรรมวัสดุ ๒	1 (0-3-1)
SCME 283	Materials Innovation Project II	
วทวน ๓๘๖	สัมมนาวัสดุศาสตร์และวิศวกรรมนาโน	1 (0-3-1)
SCME 386	Seminar in Materials Science and Nano Engineering	
วทวน ๔๘๖	โครงการวิจัยวัสดุศาสตร์	9 (0-27-9)
SCME 486	Materials Science Research Project	



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5.2 Remove some courses from the program

วทคณ ๑๙๒	สถิติศาสตร์	3 (3-0-6)
SCMA 192	Statistics	
วทวน ๓๘๓	โครงการวิจัย ๑	3 (0-9-3)
SCME 383	Senior Project I	
วทวน ๔๘๑	สัมมนาวัสดุศาสตร์และวิศวกรรมนาโน	1 (0-3-1)
SCME 481	Seminar in Materials Science and Nano Engineering I	
วทวน ๔๘๒	สัมมนาวัสดุศาสตร์และวิศวกรรมนาโน ๒	1 (0-3-1)
SCME 482	Seminar in Materials Science and Nano Engineering II	
วทวน ๔๘๓	ฝึกงาน	1 (0-3-1)
SCME 483	Internship	
วทวน ๔๘๔	โครงการวิจัย ๒	4 (0-12-4)
SCME 484	Senior Project II	

5.3 Rearrange some major required courses and major elective courses

Change code name of these courses

วทฟส ๑๘๐	ฟิสิกส์ทั่วไป	3 (3-0-6)
SCPY 180	General Physics	
วทฟส ๑๑๑	ปฏิบัติการฟิสิกส์ขั้นพื้นฐาน	1 (0-3-1)
SCPY 111	Basic Physics Laboratory	
วทฟส ๑๐๑	ชีววิทยาทั่วไป ๑	3 (3-0-6)
SCBE 101	General Biology 1	
วทฟส ๑๐๒	ปฏิบัติการชีววิทยาทั่วไป ๑	1 (0-3-1)
SCBE 102	General Biology Laboratory 1	
วทชพ ๑๒๑	ชีววิทยาระดับเซลล์และโมเลกุล	2 (2-0-4)
SCBM 121	Cell and Molecular Biology	
วทนว ๓๐๕	ทักษะสำคัญสำหรับการวิจัยทางวิทยาศาสตร์	1 (1-0-2)
SCIN 305	Essential Skills for Scientific Research	
วทวน ๓๓๐	ฟิสิกส์สถานะแข็งสำหรับวัสดุศาสตร์	3 (3-0-6)
SCME 330	Solid State Physics for Materials Science	



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วทวน ๓๖๑	สารกึ่งตัวนำและนาโนอิเล็กทรอนิกส์	3 (3-0-6)
SCME 361	Semiconductors and Nano Electronic	

Add new major elective courses

วทวน ๓๘๔	การฝึกวิจัยวัสดุศาสตร์	1 (0-3-1)
SCME 384	Materials Science Research Practice	
วทวน ๓๘๕	การฝึกวิจัยวัสดุศาสตร์และการประยุกต์	1 (0-3-1)
SCME 385	Materials Science Research Practice and Applications	
วทวน ๔๑๑	การเขียนโปรแกรมสำหรับระบบอัตโนมัติในกระบวนการผลิต	3 (3-0-6)
SCME 411	Programing for automatic system in manufacturing process	
วทวน ๔๘๕	ฝึกงานวัสดุศาสตร์และวิศวกรรมนาโน	9 (0-27-9)
SCME 485	Internship in Materials Science and Nanoengineering	

5.4 Change general education courses to the program

Remove these courses

วทชว ๑๖๓	ชีววิทยาสาระสำคัญ	2 (2-0-4)
SCBI 163	Essential Biology	
วทคร ๒๐๔	เกมกลยุทธ์	2 (1-2-3)
SCID 204	Game Strategy	
วทคร ๒๐๑	เทคนิคการเรียนรู้	1 (1-0-2)
SCID 201	Learning Techniques	
ศศภอ ๒๘๐	วรรณกรรมวิทยาศาสตร์กับสังคม	2 (2-0-4)
LAEN 280	Science Fiction and Society	
ศศภอ ๓๘๐	การนำเสนอผลงานเป็นภาษาอังกฤษ	2 (2-0-4)
LAEN 380	Academic Presentations in English	

Add these courses

วทวน ๑๐๑	การคิดสร้างสรรค์และนวัตกรรม	2 (2-0-4)
SCIN 101	Creative Thinking and Innovation	
วททส ๑๕๒	นิทัศน์ทางวิทยาศาสตร์ธรรมชาติ	3 (1-4-4)



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SCBE 152	Natural Science Illustration	
วทส ๒๕๕	สุนทรียศาสตร์ของกลิ่นและรส	3 (3-0-6)
SCBE 255	Aesthetics of Fragrance and flavor	
ศศกอ ๒๘๒	พหุภาษาและพหุวัฒนธรรม	2 (2-0-4)
LAEN 282	Multilingualism and Multiculturalism	

5.5 The revision of each subject

Remove a credit for laboratory of these courses

วทวน ๒๒๓	เคมีเชิงฟิสิกส์	4 (3-3-6)
SCME 223	Physical Chemistry	
วทวน ๒๖๒	วัสดุนาโน	3 (2-3-4)
SCME 262	Nanomaterials	

New courses

วทวน ๒๒๒	เคมีเชิงฟิสิกส์และอุณหพลศาสตร์	3 (3-0-6)
SCME 222	Physical Chemistry and Thermodynamics	
วทวน ๒๖๔	วัสดุนาโนและการประยุกต์	3 (3-0-6)
SCME 264	Nanomaterials and Applications	



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6. **Program structure after revision** compared to the previous structure and the undergraduate curriculum standard and guidelines issued by the Commission of Higher Education B.E. 2558.

Plan A

Course Category	Standard guideline of the Ministry of Education for the undergraduate level of education of the year B.E. 2558. (4-year program) (credits)	Before Revision (credits)	After Revision (credits)
1. General Education Courses	no less than 30	30	30
1. Social Sciences and Humanities		4	4
2. Languages		8	6
3. Science and Mathematics		18	20
2. Specific Courses	no less than 72	94	97
1. Core Courses		31	30
2. Major Required Courses in materials science and nanoengineering		48	50
3. Major Elective Courses in materials science and nanoengineering		15	17
3. Free Elective Courses	no less than 6	6	6
Total Credits	no less than 120	130	133



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Plan B

Course Category	Standard guideline of the Ministry of Education for the undergraduate level of education of the year B.E. 2558. (4-year program) (credits)	Before Revision (credits)	After Revision (credits)
4. General Education Courses	no less than 30	33	30
1. Social Sciences and Humanities		4	4
2. Languages		8	6
3. Science and Mathematics		21	20
5. Specific Courses	no less than 72	132	143
1. Core Courses		48	48
2. Major Required Courses in materials science and nanoengineering		54	65
3. Major Elective Courses in materials science and nanoengineering		30	30
6. Free Elective Courses	no less than 6	6	6
Total Credits	no less than 120	171	179



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Appendix 6

Details of the instructors responsible for the program, regular instructors, and special
instructors



**Appendix for details of the instructors responsible for the program, regular instructors,
and special instructors**

a. Instructors responsible for the program and regular instructors

1. Full name Rakchart Traiphol

Title / Academic title Asst Prof, PhD

Affiliation Faculty of Science, Mahidol University

Work Place Faculty of Science, Mahidol University

Education

Ph.D. (Chemistry), Clemson University, USA: 2003

B.Sc. (Chemistry), Khonkaen University: 1996

Research interests or research skills

- 1) Polymer physics
- 2) Colloid and interface science
- 3) Photophysical properties of conjugated polymers
- 4) Self assembling of polymers

**Research or academic works (according to Standards Criteria for the Higher
Education Curriculum (B.E. 2558))**

● **Research papers**

1) Potai, R., Faisadcha, K., Traiphol, R., Traiphol, N. Controllable thermochromic and phase transition behaviors of polydiacetylene/zinc(II) ion/zinc oxide nanocomposites via photopolymerization: An insight into the molecular level (2018) Colloids and Surfaces A: Physicochemical and Engineering Aspects, 555, pp. 27-36.

2) Khanantong, C., Charoenthai, N., Phuangkaew, T., Kielar, F., Traiphol, N., Traiphol, R. Phase transition, structure and color-transition behaviors of monocarboxylic diacetylene and polydiacetylene assemblies: The opposite effects of alkyl chain length (2018) Colloids and Surfaces A: Physicochemical and Engineering Aspects, 553, pp. 337-348.



- 3) Khanantong, C., Charoenthai, N., Wacharasindhu, S., Sukwattanasinitt, M., Traiphol, N., Traiphol, R. Influences of solvent media on chain organization and thermochromic behaviors of polydiacetylene assemblies prepared from monomer with symmetric alkyl tails (2018) *Journal of Industrial and Engineering Chemistry*, 58, pp. 258-265.
- 4) Kamphan, A., Khanantong, C., Traiphol, N., Traiphol, R. Structural-thermochromic relationship of polydiacetylene (PDA)/polyvinylpyrrolidone (PVP) nanocomposites: Effects of PDA side chain length and PVP molecular weight (2017) *Journal of Industrial and Engineering Chemistry*, 46, pp. 130-138.
- 5) Traiphol, N., Chanakul, A., Kamphan, A., Traiphol, R. Role of Zn²⁺ ion on the formation of reversible thermochromic polydiacetylene/zinc oxide nanocomposites (2017) *Thin Solid Films*, 622, pp. 122-129.
- 6) Chanakul, A., Traiphol, R., Traiphol, N. Utilization of polydiacetylene/zinc oxide nanocomposites to detect and differentiate organic bases in various media (2017) *Journal of Industrial and Engineering Chemistry*, 45, pp. 215-222.
- 7) Kamphan, A., Gong, C., Maiti, K., Sur, S., Traiphol, R., Arya, D.P. Utilization of chromic polydiacetylene assemblies as a platform to probe specific binding between drug and RNA (2017) *RSC Advances*, 7 (66), pp. 41435-41443.
- 8) Sansee, A., Kamphan, A., Traiphol, R., Kielar, F. Embedding luminescent iridium complex into polydiacetylene vesicles as a means of development of responsive luminescent system for imaging applications (2016) *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 497, pp. 362-369.
- 9) Kamphan, A., Traiphol, N., Traiphol, R. Versatile route to prepare reversible thermochromic polydiacetylene nanocomposite using low molecular weight poly(vinylpyrrolidone) (2016) *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 497, pp. 370-377.
- 10) Chanakul, A., Traiphol, R., Traiphol, N. Colorimetric sensing of various organic acids by using polydiacetylene/zinc oxide nanocomposites: Effects of polydiacetylene and acid structures (2016) *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 489, pp. 9-18.



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11) Kamphan, A., Charoenthai, N., Traiphol, R. Fine tuning the colorimetric response to thermal and chemical stimuli of polydiacetylene vesicles by using various alcohols as additives (2016) Colloids and Surfaces A: Physicochemical and Engineering Aspects, 489, pp. 103-112.

12) Sansee, A., Meksawangwong, S., Chainok, K., Franz, K.J., Gál, M., Pålsson, L.-O., Puniyan, W., Traiphol, R., Pal, R., Kielar, F. Novel aminoalkyl tris-cyclometalated iridium complexes as cellular stains (2016) Dalton Transactions, 45 (43), pp. 17420-17430.

Teaching responsibility

Current teaching responsibility

วทวน ๒๒๓	เคมีเชิงฟิสิกส์	4 (3-3-6)
SCME 223	Physical Chemistry	
วทวน ๒๖๒	วัสดุนาโน	3 (2-3-4)
SCME 262	Nanomaterials	
วทวน ๓๘๑	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์และวิศวกรรมนาโน ๑	1 (0-3-1)
SCME 381	Research Laboratory in Materials Science and Nano Engineering I	
วทวน ๔๗๒	หัวข้อพิเศษทางวัสดุศาสตร์และวิศวกรรมนาโน ๑	3 (3-0-6)
SCME 472	Special Topics in Materials Science and Nano Engineering	
วทวน ๔๘๖	โครงการวิจัยวัสดุศาสตร์	9 (0-27-9)
SCME 486	Materials Science Research Project	
วทคม ๑๖๑	เคมีทั่วไป	3 (3-0-6)
SCCH 161	General Chemistry	

Teaching responsibility in the new program / revised program

วทวน ๒๒๒	เคมีเชิงฟิสิกส์และอุณหพลศาสตร์	3 (3-0-6)
SCME 222	Physical Chemistry and Thermodynamics	
วทวน ๓๘๑	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์และวิศวกรรมนาโน ๑	1 (0-3-1)
SCME 381	Research Laboratory in Materials Science and Nano Engineering I	
วทวน ๔๗๒	หัวข้อพิเศษทางวัสดุศาสตร์และวิศวกรรมนาโน ๑	3 (3-0-6)
SCME 472	Special Topics in Materials Science and Nano Engineering	



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วทวน ๔๘๖	โครงการวิจัยวัสดุศาสตร์	9 (0-27-9)
SCME 486	Materials Science Research Project	
วทคม ๑๖๑	เคมีทั่วไป	3 (3-0-6)
SCCH 161	General Chemistry	



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2. Full name Chayanisa Chitichotpanya

Title / Academic title Asst Prof

Affiliation Faculty of Science, Mahidol University

Work Place Faculty of Science, Mahidol University

Education

Ph.D. (Materials Science and Engineering), University of Rochester, USA: 2004

M.Sc.(Materials Science and Engineering), University of Rochester, USA: 1997

B.Sc. (Chemistry), Chulalongkorn University: 1992

Research interests or research skills

- 1) Surface science and engineering
- 2) Surface modification and coating
- 3) Mechanical properties as well as friction and wear of brittle materials
- 4) Precision fabrication of brittle materials

Research or academic works (according to Standards Criteria for the Higher Education Curriculum (B.E. 2558))

● **Research papers**

1) Chitichotpanya, P., Pisitsak, P., Chitichotpanya, C. Sericin–copper-functionalized silk fabrics for enhanced ultraviolet protection and antibacterial properties using response surface methodology (2018) Textile Research Journal, 89, pp. 1166-1179.

2) Khwanmuang, P., Naparswad, C., Archakunakorn, S., Waicharoen, C., Chitichotpanya, C. Optimization of in situ synthesis of Ag/PU nanocomposites using response surface methodology for self-disinfecting coatings (2017) Progress in Organic Coatings, 110, pp. 104-113.

3) Khwanmuang, P., Rotjanapan, P., Phuphuakrat, A., Srichatrapimuk, S., Chitichotpanya, C. In vitro assessment of Ag-TiO₂/polyurethane nanocomposites for infection control using response surface methodology (2017) Reactive and Functional Polymers, 117, pp. 120-130.



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4) Pokai, S., Limnonthakul, P., Horprathum, M., Eiamchai, P., Pattantsetakul, V.,
Limwichean, S., Nuntawong, N., Porntheeraphat, S., Chitichotpanya, C. Influence of seed
layer thickness on well-aligned ZnO nanorods via hydrothermal method (2017) Materials
Today: Proceedings, 4 (5), pp. 6336-6341.

Teaching responsibility

Current teaching responsibility

วทวน ๑๐๑	หลักการขึ้นแนะนำทางวัสดุศาสตร์	3 (3-0-6)
SCME 101	Introduction to Materials	
วทคม ๑๘๙	ปฏิบัติการเคมี	1 (0-3-1)
SCCH 189	Chemistry Laboratory	

Teaching responsibility in the new program / revised program

วทวน ๑๐๑	หลักการขึ้นแนะนำทางวัสดุศาสตร์	3 (3-0-6)
SCME 101	Introduction to Materials	
วทคม ๑๘๙	ปฏิบัติการเคมี	1 (0-3-1)
SCCH 189	Chemistry Laboratory	



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3. Full name Pongsakorn Kanjanaboos

Title / Academic title Asst Prof, PhD

Affiliation Faculty of Science, Mahidol University

Work Place Faculty of Science, Mahidol University

Education

MS-PHD. (Physics), University of Chicago, USA (2013)

BA (Physics and Economics), Washington University in Saint Louis, USA (2008)

Research interests or research skills

- 1) Solution processed thin films
- 2) Solar cells, LEDs, and other optoelectronic devices
- 3) Microscopies, nano-mechanics, and nanotechnology

Research or academic works (according to Standards Criteria for the Higher Education Curriculum (B.E. 2558))

● **Research papers**

1) Boonthum, C., Pinsuwan, K., Ponchai, J., Srihirin, T., Kanjanaboos, P. Reconditioning perovskite films in vapor environments through repeated cation doping (2018) Applied Physics Express, 11 (6), art. no. 065503.

2) Shaikh, J.S., Shaikh, N.S., Kharade, R., Beknalkar, S.A., Patil, J.V., Suryawanshi, M.P., Kanjanaboos, P., Hong, C.K., Kim, J.H., Patil, P.S. Symmetric supercapacitor: Sulphurized graphene and ionic liquid (2018) Journal of Colloid and Interface Science, 527, pp. 40-48.

3) Shaikh, J.S., Shaikh, N.S., Mali, S.S., Patil, J.V., Pawar, K.K., Kanjanaboos, P., Hong, C.K., Kim, J.H., Patil, P.S. Nanoarchitectures in dye-sensitized solar cells: Metal oxides, oxide perovskites and carbon-based materials (2018) Nanoscale, 10 (11), pp. 4987-5034.

4) Shaikh, J.S., Shaikh, N.S., Sheikh, A.D., Mali, S.S., Kale, A.J., Kanjanaboos, P., Hong, C.K., Kim, J.H., Patil, P.S. Perovskite solar cells: In pursuit of efficiency and stability (2017) Materials and Design, 136, pp. 54-80.



5) Jang, Y.H., Rani, A., Quan, L.N., Adinolfi, V., Kanjanaboos, P., Ouellette, O., Son, T., Jang, Y.J., Chung, K., Kwon, H., Kim, D., Kim, D.H., Sargent, E.H. Graphene Oxide Shells on Plasmonic Nanostructures Lead to High-Performance Photovoltaics: A Model Study Based on Dye-Sensitized Solar Cells (2017) *ACS Energy Letters*, 2 (1), pp. 117-123.

6) Griesemer, S.D., You, S.S., Kanjanaboos, P., Calabro, M., Jaeger, H.M., Rice, S.A., Lin, B. The role of ligands in the mechanical properties of Langmuir nanoparticle films (2017) *Soft Matter*, 13 (17), pp. 3125-3133.

7) Yassitepe, E., Yang, Z., Voznyy, O., Kim, Y., Walters, G., Castañeda, J.A., Kanjanaboos, P., Yuan, M., Gong, X., Fan, F., Pan, J., Hoogland, S., Comin, R., Bakr, O.M., Padilha, L.A., Nogueira, A.F., Sargent, E.H. Amine-Free Synthesis of Cesium Lead Halide Perovskite Quantum Dots for Efficient Light-Emitting Diodes (2016) *Advanced Functional Materials*, 26 (47), pp. 8757-8763.

8) Yuan, M., Quan, L.N., Comin, R., Walters, G., Sabatini, R., Voznyy, O., Hoogland, S., Zhao, Y., Beauregard, E.M., Kanjanaboos, P., Lu, Z., Kim, D.H., Sargent, E.H. Perovskite energy funnels for efficient light-emitting diodes (2016) *Nature Nanotechnology*, 11 (10), pp. 872-877.

9) Xu, J., Voznyy, O., Comin, R., Gong, X., Walters, G., Liu, M., Kanjanaboos, P., Lan, X., Sargent, E.H. Crosslinked Remote-Doped Hole-Extracting Contacts Enhance Stability under Accelerated Lifetime Testing in Perovskite Solar Cells (2016) *Advanced Materials*, 28 (14), pp. 2807-2815.

10) Wang, R., Shang, Y., Kanjanaboos, P., Zhou, W., Ning, Z., Sargent, E.H. Colloidal quantum dot ligand engineering for high performance solar cells (2016) *Energy and Environmental Science*, 9 (4), pp. 1130-1143.

11) Kim, G.-H., García De Arquer, F.P., Yoon, Y.J., Lan, X., Liu, M., Voznyy, O., Krishnan Jagadamma, L., Saud Abbas, A., Yang, Z., Fan, F., Ip, A.H., Kanjanaboos, P., Hoogland, S., Amassian, A., Kim, J.Y., Sargent, E.H. Correction to High-Efficiency Colloidal Quantum Dot Photovoltaics via Robust Self-Assembled Monolayers (2016) *Nano Letters*, 16 (1), p. 822.

12) Lan, X., Voznyy, O., Kiani, A., García De Arquer, F.P., Abbas, A.S., Kim, G.-H., Liu, M., Yang, Z., Walters, G., Xu, J., Yuan, M., Ning, Z., Fan, F., Kanjanaboos, P., Kramer, I., Zhitomirsky, D., Lee, P., Perelgut, A., Hoogland, S., Sargent, E.H. Passivation Using Molecular



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Halides Increases Quantum Dot Solar Cell Performance (2016) *Advanced Materials*, 28 (2), pp. 299-304.

13) Adinolfi, V., Yuan, M., Comin, R., Thibau, E.S., Shi, D., Saidaminov, M.I., Kanjanaboos, P., Kopilovic, D., Hoogland, S., Lu, Z.-H., Bakr, O.M., Sargent, E.H. The In-Gap Electronic State Spectrum of Methylammonium Lead Iodide Single-Crystal Perovskites (2016) *Advanced Materials*, 28 (17), pp. 3406-3410.

Teaching responsibility

Current teaching responsibility

วทวน ๑๓๐	วิทยาศาสตร์และเทคโนโลยีด้านพลังงาน	3 (3-0-6)
SCME 130	Energy Sciences and Technology	
วทวน ๓๗๒	วิทยาศาสตร์และนวัตกรรม	3 (3-0-6)
SCME 372	Scientific Creativity and Innovation	
วทวน ๒๓๑	โมเดิร์นฟิสิกส์และกลศาสตร์ควอนตัม	3 (3-0-6)
SCME 231	Modern Physics and Quantum Mechanics	
วทวน ๓๗๑	การตลาดและการเป็นผู้ประกอบการ	3 (3-0-6)
SCME 371	Marketing and Entrepreneurship	
วทวน ๓๘๒	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์และวิศวกรรมนาโน ๒	1 (0-3-1)
SCME 382	Research Laboratory in Materials Science and Nano Engineering II	

Teaching responsibility in the new program / revised program

วทวน ๑๓๐	วิทยาศาสตร์และเทคโนโลยีด้านพลังงาน	3 (3-0-6)
SCME 130	Energy Sciences and Technology	
วทวน ๓๗๒	วิทยาศาสตร์และนวัตกรรม	3 (3-0-6)
SCME 372	Scientific Creativity and Innovation	
วทวน ๒๓๑	โมเดิร์นฟิสิกส์และกลศาสตร์ควอนตัม	3 (3-0-6)
SCME 231	Modern Physics and Quantum Mechanics	
วทวน ๓๗๕	หลักสูตรกิจพื้นฐานสำหรับนักวิทยาศาสตร์ผู้ประกอบการ	3 (3-0-6)
SCME 375	Business Concepts for Science Entrepreneurs	



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วทวน ๓๘๒	ปฏิบัติการเชิงวิจัยวัสดุศาสตร์และวิศวกรรมนาโน ๒	1 (0-3-1)
SCME 382	Research Laboratory in Materials Science and Nano Engineering II	
วทวน ๔๘๖	โครงการวิจัยวัสดุศาสตร์	9 (0-27-9)
SCME 486	Materials Science Research Project	



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4. Full name Tanant Waritanant

Title / Academic title Lecturer

Affiliation Faculty of Science, Mahidol University

Work Place Faculty of Science, Mahidol University

Education

Ph.D. (Engineering), University of Manitoba, Canada: 2017

M.Sc. (Optics and Photonics), National Central University, Taiwan: 2011

B. Eng. (Electronic) Chulalongkorn University: 2009

Research interests or research skills

- 1) High power laser/photonics
- 2) Ultrafast lasers and their biomedical applications

Research or academic works (according to Standards Criteria for the Higher Education Curriculum (B.E. 2558))

● **Research papers**

1) Nadimi, M., Waritanant, T., Major, A. Thermal lensing in Nd:GdVO₄ laser with direct in-band pumping at 912 nm (2018) Applied Physics B: Lasers and Optics, 124 (8), 170.

2) Waritanant T., Major A. Dual-wavelength operation of a diode-pumped Nd:YVO₄ laser at the 1064.1 & 1073.1 nm and 1064.1 & 1085.3 nm wavelength pairs (2018) Applied Physics B: Lasers and Optics, 124 (5), 87.

3) Nadimi M., Waritanant T., Major A. Discrete multi-wavelength tuning of a continuous wave diode-pumped Nd:GdVO₄ laser (2018) Laser Physics Letters, 15 (5), 055002.

4) Nadimi M., Waritanant T., Major A. Passively mode-locked high power Nd:GdVO₄ laser with direct in-band pumping at 912 nm (2018) Laser Physics Letters, 15 (1), 015001.

5) Waritanant T., Major A. Discretely selectable multiwavelength operation of a semiconductor saturable absorber mirror mode-locked Nd:YVO₄ laser (2017) Optics Letters, 42 (17), pp. 3331-3334.



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6) Nadimi M., Waritanant T., Major A. High power and beam quality continuous-wave Nd:GdVO₄ laser in-band diode-pumped at 912 nm (2017) *Photonics Research*, 5 (4), pp. 346-349.

7) Waritanant T., Major A. Diode-pumped Nd:YVO₄ laser with discrete multi-wavelength tunability and high efficiency (2017) *Optics Letters*, 42 (6), pp. 1149-1152.

8) Eibna Halim M.Z., Talukder R.C., Waritanant T., Major A. Passive mode locking of a Nd:KGW laser with hot-band diode pumping (2016) *Laser Physics Letters*, 13 (10), 105003.

9) Talukder R.C., Halim Md.Z.E., Waritanant T., Major A. Multiwatt continuous wave Nd:KGW laser with hot-band diode pumping (2016) *Optics Letters*, 41 (16), pp. 3810-3812.

10) Waritanant T., Major A. High efficiency passively mode-locked Nd:YVO₄ laser with direct in-band pumping at 914 nm (2016) *Optics Express*, 24 (12), pp. 12851-12855.

11) Waritanant T., Major A. Thermal lensing in Nd:YVO₄ laser with in-band pumping at 914 nm (2016) *Applied Physics B: Lasers and Optics*, 122 (5), 135.

Teaching responsibility

Current teaching responsibility

วทวน ๒๖๒	วัสดุนาโน	3 (2-3-4)
SCME 262	Nanomaterials	
วทวน ๓๓๓๓	เทคโนโลยีฟิล์มบางและการประดิษฐ์โครงสร้างนาโน	3 (3-0-6)
SCME 333	Thin Film Technology and Nanostructure Fabrication	

Teaching responsibility in the new program / revised program

วทวน ๒๖๔	วัสดุนาโน	2 (2-0-4)
SCME 264	Nanomaterials	
วทวน ๓๓๓๓	เทคโนโลยีฟิล์มบางและการประดิษฐ์โครงสร้างนาโน	3 (3-0-6)
SCME 333	Thin Film Technology and Nanostructure Fabrication	



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5. Full name Yodchay Jompol

Title / Academic title Lecturer

Affiliation Faculty of Science, Mahidol University

Work Place Faculty of Science, Mahidol University

Education

Ph.D. in Physics, University of Cambridge, UK: 2008

M.Sc. in Physics, Chalmers University of Technology, Sweden: 2001

B.Sc. (Physics), Chulalongkorn University: 1998

Research interests or research skills

- 1) Quantum Transports in Semiconductor Nanostructures (experiment)
- 2) Carbon Nanotubes and Nanowires
- 3) Low-temperature and low-noise measurements

Research or academic works (according to Standards Criteria for the Higher Education Curriculum (B.E. 2558))

● **Research papers**

1) Roche, B., Roulleau, P., Jullien, T., Jompol, Y., Farrer, I., Ritchie, D.A., Glattli, D.C.

Harvesting dissipated energy with a mesoscopic ratchet (2015) Nature Communications, 6, art. no. 6738

2) Jompol, Y., Roulleau, P., Jullien, T., Roche, B., Farrer, I., Ritchie, D.A., Glattli, D.C.

Detecting noise with shot noise using on-chip photon detector (2015) Nature Communications, 6, art. no. 6130

Teaching responsibility

Current teaching responsibility

วทวน ๒๖๑	เครื่องสแกนนิ่งโพรบและกล้องจุลทรรศน์อิเล็กตรอน	3 (3-0-6)
SCME 261	Scanning Probe and Electron Microscopy	
วทฟส ๓๗๘	สารกึ่งตัวนำและนาโนอิเล็กทรอนิกส์	3 (3-0-6)



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SCME 378	Semiconductor and Nano Electronics	
วทวน ๓๓๒	วัสดุแม่เหล็กและวัสดุอิเล็กทรอนิกส์	3 (3-0-6)
SCME 332	Magnetic and Electronic Materials	

Teaching responsibility in the new program / revised program

วทวน ๒๖๑	เครื่องสแกนนิ่งโพรบและกล้องจุลทรรศน์อิเล็กตรอน	3 (3-0-6)
SCME 261	Scanning Probe and Electron Microscopy	
วทฟส ๓๗๘	สารกึ่งตัวนำและนาโนอิเล็กทรอนิกส์	3 (3-0-6)
SCME 378	Semiconductor and Nano Electronics	
วทวน ๓๓๒	วัสดุแม่เหล็กและวัสดุอิเล็กทรอนิกส์	3 (3-0-6)
SCME 332	Magnetic and Electronic Materials	



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Table: Name lists of regular instructors

No.	Full Names	Academic Titles	Graduate Degree and Institutions	Affiliations	Most recent Academic Works in 5 years
1	Mr. Rakchart Traiphol*	Asst Prof	- Ph.D. (Chemistry), Clemson University, USA: 2003 - B.Sc. (Chemistry), Khonkaen University: 1996	Faculty of Science, Mahidol University	Potai, R., Faisadcha, K., Traiphol, R., Traiphol, N. Controllable thermochromic and phase transition behaviors of polydiacetylene/zinc(II) ion/zinc oxide nanocomposites via photopolymerization: An insight into the molecular level (2018) Colloids and Surfaces A: Physicochemical and Engineering Aspects, 555, pp. 27- 36.
2	Ms. Chayanisa Chitichotpanya*	Asst Prof	- Ph.D. (Materials Science and Engineering), University of Rochester, USA: 2004 - M.Sc. (Materials Science and Engineering), University of Rochester, USA: 1997	Faculty of Science, Mahidol University	Chitichotpanya, P., Pisitsak, P., Chitichotpanya, C. Sericin-copper- functionalized silk fabrics for enhanced ultraviolet protection and antibacterial properties using response surface



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No.	Full Names	Academic Titles	Graduate Degree and Institutions	Affiliations	Most recent Academic Works in 5 years
			- B.Sc. (Chemistry), Chulalongkorn University: 1992		methodology (2018) Textile Research Journal, 89, pp. 1166- 1179.
3	Mr. Pongsakorn Kanjanaboos*	Asst Prof	- MS-PHD. (Physics), University of Chicago, USA: 2013 - BA (Physics and Economics), Washington University in Saint Louis, USA: 2008	Faculty of Science, Mahidol University	Boonthum, C., Pinsuwan, K., Ponchai, J., Srihirin, T., Kanjanaboos, P. Reconditioning perovskite films in vapor environments through repeated cation doping (2018) Applied Physics Express, 11 (6), art. no. 065503.
4	Mr. Tanant Waritanant*	Lecturer	- Ph.D. (Engineering), University of Manitoba, Canada: 2017 - M.Sc. (Optics and Photonics), National Central University, Taiwan: 2011 - B. Eng. (Electronic) Chulalongkorn University: 2009	Faculty of Science, Mahidol University	Nadimi, M., Waritanant, T., Major, A. Thermal lensing in Nd:GdVO ₄ laser with direct in- band pumping at 912 nm (2018) Applied Physics B: Lasers and Optics, 124 (8), 170.



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No.	Full Names	Academic Titles	Graduate Degree and Institutions	Affiliations	Most recent Academic Works in 5 years
5	Mr. Yodchay Jompol*	Lecturer	- Ph.D. in Physics, University of Cambridge, UK: 2008 - M.Sc. in Physics, Chalmers University of Technology, Sweden: 2001 - B.Sc. (Physics), Chulalongkorn University: 1998	Faculty of Science, Mahidol University	Roche, B., Roulleau, P., Jullien, T., Jompol, Y., Farrer, I., Ritchie, D.A., Glattli, D.C. Harvesting dissipated energy with a mesoscopic ratchet (2015) Nature Communications, 6, art. no. 6738
6	Ms. Dakrong Pissuwan	Asst Prof	Ph.D. Science (Nanobiotechnology), University of Technology Sydney, Australia: 2008 M.Sc. (Applied Microbiology), King Mongkut's University of Technology Thonburi: 1999 B.Sc. (Microbiology), Srinakharinwirot University: 1994	Faculty of Science, Mahidol University	Sukwong, P., Kongseng, S., Chaicherd, S., Yoovathaworn, K., Tubtimkuna, S., Pissuwan, D. Comparison effects of titanium dioxide nanoparticles on immune cells in adaptive and innate immune system (2017) IET Nanobiotechnology 11 (7), pp. 759-765.
7	Mr. Kittitat Subannajui	Assoc Prof	Ph.D. (Microsystem Engineering), Alber-Ludwig University of	Faculty of Science,	Boonniyom, S., Osotchan, T., Subannajui, K. Hot



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No.	Full Names	Academic Titles	Graduate Degree and Institutions	Affiliations	Most recent Academic Works in 5 years
			Freiburg, Germany: 2011 M.Sc. (Materials Science and Engineering) Christian Albrechts University of Kiel, Germany: 2006 B.Eng. (Metallurgical Engineering), Chulalongkorn university: 2002	Mahidol University	embossing of anodic aluminium oxide on high-density polyethylene: A deeper understanding based on hard surface coating (2018) Micro and Nano Letters, 13 (3), pp. 357-362.
8	Mr. Thammasit Vongsetskul	Assoc Prof	Ph.D. (Physical and Theoretical Chemistry) University of Oxford, UK : 2008 M.Sc. (Polymer) The Petroleum and Petrochemical College, Chulalongkorn university: 2004 B.Sc. (Chemistry), Chulalongkorn university: 2002	Faculty of Science, Mahidol University	Boriboon, D., Vongsetskul, T., Limthongkul, P., Kobsiriphat, W., Tammawat, P. Cellulose ultrafine fibers embedded with titania particles as a high performance and eco-friendly separator for lithium-ion batteries (2018) Carbohydrate Polymers, 189, pp. 145-151.
9	Ms. Manthana Jariyaboon	Asst Prof	Ph.D. (Metallurgy and Materials),	Faculty of Science,	Rujeerapaiboon, N., Anuwongnukroh, N.,



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No.	Full Names	Academic Titles	Graduate Degree and Institutions	Affiliations	Most recent Academic Works in 5 years
			University of Birmingham, UK: 2006 M.Sc. (Analytical and Applied Inorganic Chemistry), Mahidol University: 2001 B.Sc. (Chemistry), Mahidol University: 1998	Mahidol University	Dechkunakorn, S., Jariyaboon, M. The effects of different bending techniques on corrosion resistance and nickel release of superelastic orthodontic NiTi archwires (2017) IOP Conference Series: Materials Science and Engineering, 191 (1), 012038.
10	Ms. Supa Wirasate	Asst Prof	Ph.D. (Chemical and Materials Engineering: Polymer major), University of Cincinnati, Ohio, USA: 2005 M.S. (Polymer) Petroleum and Petrochemical College, Chulalongkorn University: 1996 B.Sc. (Materials Science), Chulalongkorn University: 1994	Faculty of Science, Mahidol University	Kosai, U., Wirasate, S. Preparation and properties of peroxide prevulcanized natural rubber/Ag nanocomposites: effect of AgNO ₃ adding sequence on mechanical and antimicrobial properties (2019) Composite Interfaces, 26 (3), pp. 233-246.



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No.	Full Names	Academic Titles	Graduate Degree and Institutions	Affiliations	Most recent Academic Works in 5 years
11	Mr. Toemsak Srikhirin	Asst Prof	Ph.D.(Polymer Science and Engineering) Case Western Reserve University, USA: 1998 B.Sc. (Chemistry), King Mongkut's University of Technology Thonburi: 1991	Faculty of Science, Mahidol University	Juagwon, T., Lertvachirapaiboon, C., Shinbo, K., Kato, K., Srikhirin, T., Osotchan, T., Baba, A. Detection of human immunoglobulin G by transmission surface plasmon resonance using the in situ gold nanoparticle growth method (2019) IEICE Transactions on Electronics, E102C(2), pp. 125-131.
12	Mr. Tanakorn Osotchan	Asst Prof	Ph.D. (Physics) Macquarie University, Australia: 1995 M.Sc. (Physics) Chulalongkorn University: 1989 B.Sc (Physics) Kasetsart University: 1986	Faculty of Science, Mahidol University	Somdee, A., Osotchan, T. Effect of precipitating agent NaOH on the synthesis of SrTiO ₃ /TiO ₂ heterostructure for dye-sensitized solar cells (2019) Materials Chemistry and Physics, 229, pp. 210-214.
13	Mr. Teerakiat Kerdcharoen	Asst Prof	Dr rer nat (Physical Chemistry) University of	Faculty of Science,	Siyang, S., Nilpanapan, T., Kerdcharoen, T. Development of IoT-



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No.	Full Names	Academic Titles	Graduate Degree and Institutions	Affiliations	Most recent Academic Works in 5 years
			Innsbruck , Austria: 1995 M.Sc. (Physical Chemistry): Chulalongkorn University 1992 B.Sc. (Chemisty) Chulalongkorn University: 1989	Mahidol University	Based Data Shoes for Daily Life Step Count (2018) 2018 IEEE 7th Global Conference on Consumer Electronics, GCCE 2018, 8574793, pp. 442-446.



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Appendix 7

Mahidol University Regulations on Diploma and Undergraduate Studies
of the Year B.E. 2552-2560
and the affiliation's educational announcements/regulations



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Mahidol University Regulations on Diploma and Undergraduate Studies, B.E. 2552 (2009)

Rules and guidelines for diploma and undergraduate studies are to be enforced in accordance with Mahidol University’s act, 2007.

Mahidol University Council, under Section 24 (2) of Mahidol University Act B.E.2550 (2007), agreed to enact the following regulations in its 526th meeting, April 22, 2009.

Rule 1: These regulations are referred to as “Mahidol University Regulations on Diploma and Undergraduate Studies, B.E. 2552 (2009)”

Rule 2: These regulations shall become effective for the diploma and undergraduate students who enroll at Mahidol University in 2009 academic year onwards.

Rule 3: In these regulations

“University”	means	Mahidol University
“Faculty”	means	Faculties and divisions otherwise named, equivalent to other faculties that conduct teaching.
“Faculty committee”	means	Committee of the faculties and other divisions named equivalent to the faculties that conduct teaching.
“Dean”	means	Head of the faculties or other divisions, otherwise named, equivalent to the faculties that conduct teaching.
“Curriculum”	means	Diploma and undergraduate curriculum that supports the policies or operation or regulations and rules of Federations or Division of Art of Healing (if any) approved by the university council and acknowledged by the Higher Education Commission.
“Program Lecturers”	means	Lecturers in the diploma or undergraduate program.
“Program Committee”	means	Committee appointed by the Dean to manage and take the curriculum under consideration.



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Rule 4: Admission

University or faculty, through the faculty committee, can accept students according to the conditions and methods indicated in the curriculum or the faculty's announcements approved by the president. Admission can be classified into three types;

- 4.1 Students are accepted by the quota system.
- 4.2 Students are accepted through the Office of Higher Education Commission.
- 4.3 Faculty can select and accept students directly according to the faculty's announcement which has been approved by the university.

Rule 5: Teaching System

- 5.1 **Semester System:** each academic year is divided into two regular semesters; Semester 1 and Semester 2. Each semester consists of at least 15 weeks broken into intervals. A faculty can organize a summer session if necessary. However, the summer session time period and registered credits must be comparable to the regular semester.
- 5.2 **Trimester System:** each academic year consists of three regular terms which are Trimester 1, Trimester 2, and Trimester 3, with at least 12 weeks in each trimester with semester breaks. The faculty can organize a summer session if necessary. However, the summer session time period and credit registration must be comparable to the regular semester.
- 5.3 **Others:** Faculty may use another system, the details of which must be clearly given in the curriculum period and credit registration must be equivalent to the semester or the trimester system.

Rule 6: Credits in each course are assigned according to the following criteria.

6.1 Semester System

- 1. A theoretical course with lectures or discussions or equivalent that is one hour per week or at least 15 hours per semester and two hours self-study per week or at least 30 hours per semester is assigned one semester credit.
- 2. A practical, laboratory course, or equivalent that is 2-3 hours per week or 30-45 hours per semester, and one hour self-study per week or 15 hours per semester is assigned one semester credit.



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3. An internship, a project or any learning activity that has been assigned which is 3-6 hours per week or 45-90 hours per semester, and one hour self-study per week or 15 hours per semester is assigned one semester credit.

6.2 Trimester System

1. A theoretical lecture course or equivalent that is one hour per week or at least 12 hours per semester, and two hours self-study per week or at least 24 hours per semester is assigned one trimester credit.
2. A practice, laboratory course or equivalent that is 2-3 hours per week or 24-36 hours per semester, and one hour self-study per week or 12 hours per semester is assigned one trimester credit.
3. An internship, a project or any learning activity that has been assigned which is 3-6 hours per week or 36-72 hours per semester, and one hour self-study per week or 12 hours per semester is assigned one trimester credit.

6.3 If Rule 6.1 or 6.2 cannot be applied, the faculty committee or the person appointed by the faculty committee can assign the credits for each course as he/she sees fit and clearly details how they compare with the semester credit system in the curriculum.

Rule 7: Total credits and time of study

7.1 In an undergraduate study (4 years), the total number of credits must be at least 120 semester credits or 150 trimester credits, and the maximum time of study is 8 academic years.

7.2 In an undergraduate study (5 years), the total number of credits must be at least 150 semester credits or 187.5 trimester credits, and the maximum study time is 10 academic years.

7.3 In an undergraduate study (not less than 6 years), the total number of credits must be at least 180 semester credits or 225 trimester credits, and the maximum study time is 12 academic years.

7.4 In an undergraduate study (continuing), the total number of credits must be at least 72 semester credits or 90 trimester credits, and the maximum study time is 4 academic years.



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An undergraduate study (continuing) has to be considered as part of an undergraduate study and must reflect the philosophy and contents of that particular undergraduate curriculum completely. The word “continuing” must be clearly written put in the parentheses after the name of the program.

In all cases, study time is to be counted from the first day of the first term for which the student has been accepted in that program.

Rule 8: Symbols showing evaluation results

8.1 Symbols and their assigned scores

Grade results of each course may be shown in symbolic type as follows;

Symbol	Score
A	4.00
B+	3.50
B	3.00
C+	2.50
C	2.00
D+	1.50
D	1.00
F	0.00

8.2 Symbols without scores

Grade results of each course may be shown in symbolic type as follows;

Symbol	Meaning
AU	Study which leads to no credit (Audit)
I	Awaiting for evaluation (Incomplete)
P	The study is incomplete (In Progress)
S	Satisfactory
T	Transfer of credit
U	Unsatisfactory
W	Withdraw
X	No report

8.3 Grading system



1. Symbols with at least 2.00 points, or the symbol S, means **Pass** in that course
2. Symbols with 1.00 or 1.5 points, or the symbol U, means that knowledge or ability of the student is below average. Other grading results are at the discretion of the faculty committee or the person appointed by the committee. On re-grading a course, the grade score will be 2.00 (or S), at the maximum.

8.4 F will be given in the following situations;

1. The student took the examination and failed in the exam or project.
2. The student was absent from the exam without any permission from the faculty committee or person appointed by the faculty committee.
3. The student was not allowed to take the exam according to Rule 11.
4. The student violated the examination regulation; for example, being late to the exam, dressed inappropriately according to student uniform regulation or act as in Rule 22.
5. The student who received an I and did not take the exam or finish the project within one regular semester or trimester after they received the I grade, except that the student has the permission as in Rules 15.1 and 15.2.
6. The student who received a P and did not take the exam and/or did not hand in report on time.
7. The student who does not re-take the exam or re-do the project as indicated in 8.3 (2), or the student has re-taken the exam or re-done the project and is still evaluated as "failed".

8.5 S or U are given only in non-credit courses or courses with credits for which the faculty has decided to use the non-score grading system.

8.6 AU is given only in the courses in which the student gives his/her intention to study for no credit and the student must participate in classes or practical activities not less than 80 percent of the total study time and practice time period must not be less than 80 percent.

8.7 I will be given in according to the following situations;

1. The student did not come to the exam or did not hand in the report in time due to ill health, as evidenced by a medical certificate endorsed by the university's Health Service Unit. However, the final decision will be made by the person appointed by the committee.



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2. The student was not allowed to take the exam according to Rule 11 due to ill health, as evidenced by a medical certificate endorsed by the university's Health Service Unit. However, the final decision will be made by the committee.
3. The student was not able to take the exam or hand in the report due to force majeure. However, the final decision will be made by the person appointed by the committee.

8.8 **P can be** given only in the courses in which the classes are still on going, and/or the courses last longer than one semester/trimester.

8.9 **T can be given** in the case that the credits for the course have been transferred from another faculty or institute.

8.10 **W will be given** in the following situations;

1. The student is allowed to withdraw from the courses according to Rule 10.3.
2. The student is allowed to take a leave.
3. The student is suspended.

8.11 **X can be given** only in courses in which the faculty has not yet received the grade report.

Rule 9: Registration

Students have to register for courses and the total credits must be no less than specified in the curriculum according in the following criteria.

9.1 For a full time student, the number of registered credits should be no less than 9 and no more than 22 credits in each regular session. In the summer session, the number of registered credits can be no greater than 9. Registration will be completed only if the student has completed everything in the specified time period.

The faculty may allow registration which differs from the above criteria if necessary. However, changes must not disrupt the standard and quality of learning, while the total number of registered credits must be as specified in the curriculum

9.2 Re-registration or re-grading can be done in the following situations;

1. The student received F or W or U, or the committee or the person appointed by the committee agreed that the student should re-grade according to Rule 8.3(2). If it is an



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elective course, a student is allowed to register for any other elective courses instead.

Or,

2. The student has to re-grade in order to improve CUM-GPA, in which case the approval of the advisor and instructor is needed.
3. The student is allowed to re-grade in each course as stated in Rules 9.2(1) and 9.2 (2), at the number of times set by the faculty, but no more than twice, except when the student has been allowed to take a leave according to Rules 15.1(2), 15.1(2), and 15.1(3).

9.3 Registration in more than one program

A student who wants to study in more than one program can register for courses according to Rule 9.1 for each program. Once the student completes all courses required in each program of study, the student receives a degree of that program. However, the study time must not exceed 8 academic years, counted from his/her first enrollment in the undergraduate study.

Rule 10: Add, drop, and withdrawal

A student can request to add, drop, and withdraw from courses provided the instructors approves and the request has to be approved by the Dean or a person appointed by the Dean. Approval is given according to the following criteria;

10.1 Adding: Request for adding the course must be done within the second week of a regular session, counted from the session's starting date or within the first week of summer session. For the courses that are not offered at the start of that session, adding can be requested in the first week of that course counted from the time the course starts.

10.2 Dropping: Dropped courses will not be shown in the transcript or grade report. The course will not be counted as having been registered once if dropping is done within the second week of a regular session, counted from the session's starting date or within the first week of the summer session. For the courses that are not offered at the start of that session, dropping can be requested in the first week of that course counted from the time when the course starts.

10.3 Withdrawal: Course withdrawal can be done after the second week of the regular session or after the first week of the summer session, or after the first week of the courses that do not start at the start of the session, until the week before the exams are



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held. Courses that are withdrawn will be shown in the transcript and grade report, and the course is counted as registered once.

Reasons must be given for either approval or disapproval by the Dean or an appointed person.

Rule 11: Study time

The student has to be present in a theoretical, lecture, practice, internship, or field study no less than 80 percent of the total study time of that course in order to be allowed to take the exam.

Rule 12: Credits counting

12.1 Credits identified as “pass” will be counted in order to complete the program of study.

Only the credits for courses that have been given a “pass” grade are to be counted towards graduation. If the student has re-graded the course; only the credits of the course last registered for will be counted if evaluated as passed, and counted only once.

12.2 All scored credits will be counted to calculate the CUM-GPA.

If a student registers for the course more than once, only the latest score will be considered and used to calculate the CUM-GPA.

Rule 13: Calculating GPA

There are 2 types of GPA; GPA per session and CUM-GPA. GPA can be calculated as follows;

13.1 **GPA per session** is calculated from the grades in that session by dividing the sum of the products of the score and the number of credits by the total number of credits in that session. GPA is rounded off to two decimal places.

13.2 **CUM-GPA** is calculated from the first session of study to the last session by dividing the sum of all the products of the score and the number of credits by the total number of credits earned under Rule 12.2. CUM-GPA is rounded off to two decimal places.

If a student has registered for a course more than once, only the latest score is used.

Rule 14: Credits Transfer

A student who changes division or faculties within the university, or transfers from another institute is allowed to request credit transfer in order to acquire the total number of credits in the



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program without having to register for those courses again. The transferred courses are shown as T in the transcript and grade report. The transfer of credits or courses can be done only for a student who has been approved to take such courses by the program committee or the person appointed by the faculty committee to be responsible for the program of study from which the transfer is to be made.

14.1 Credits transfer conditions

1. The standard quality of the institute from which the credits are transferred to Mahidol University must be comparable to that of Mahidol University's, and approval must be given by the program committee.
2. The course content must overlap with at least three quarters of the content of the corresponding course, or group of courses, in the university, and the courses must be approved by the program committee.
3. The transferred courses must have been registered for within the last 5 years, if not the decision is up to the program committee.
4. The transferred courses must receive at least Grade C or the equivalence.
5. Credits transfer can be made at most half of the total number of credits in that program.

14.2 In order to transfer the credits, the student has to write a letter to the Dean together with documents related to the course under consideration. Then the program committee and/or the faculty committee considers the request and gives reasons for approval. The matter is then presented to the university and/or the president for approval.

14.3 Grades of transferred courses are shown in the transcript and grade report as T and are not used to calculate the GPA or CUM-GPA.

14.4 Students with transferred courses according to Rules 14.1(1)-14.1(3) are able to receive a degree with honors complying with Rule 21.

14.5 Courses that do not follow the regulation, can still be transferred under the program committee and/or faculty committee with the university/president's approval in compliance with Rule 14.1

Rule 15: Leave of Absence

15.1 A student can request for leave of absence in the following situations;

1. Being conscripted or drafted for the army or military service.



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2. Receiving grants to go abroad or on an exchange program under the university's approval.
3. Being sick or having health problems requiring more than 20 percent of class time in order to recover or to be cured as evidenced by a medical certificate endorsed by the Student Health Service of the university.
4. A student having personal reasons may ask for leave provided the student has been studying in the university for at least one session and has a CUM-GPA of at least 2.00.

Under Rule 15.1, the student has to request for leave as soon as possible to get approval from the Dean or the appointed person.

15.2 Under the force majeure, students' reasons may not come under Rule 15.1. The student must request for leave as soon as possible to get approval from the faculty committee or the person appointed by the faculty committee.

15.3 On the approval of leave of absence under Rules 15.1 and 15.2, the maximum time allowed is two regular semesters or 3 regular trimesters. If more time for leave of absence is needed, the student has to request for another leave of absence according to Rule 15.1 or 15.2.

15.4 During a leave of absence, study time is still counted: except in the case of 15.1(1) and 15.1(2) or other force majeure approved by the president.

15.5 During the leave, the student must maintain student status by paying fees according to university regulations; otherwise the student status will not be maintained.

15.6 If a student who has been approved leave wishes to return to study, the student has to request for re-admission to the Dean or the appointed person at least 1 week before the registration period.

Reasons must be given for approval or disapproval of leave of absence by the Dean or an appointed person.

Rule 16: Student Status Classification

16.1 Student status for a freshman is classified at the end of the second semester or trimester after entry. From sophomore onwards, classification is made at the end of each regular session or at the end of the academic year for the continuing program of study. For



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students who request to graduate with a diploma or a bachelor's degree, classification may be done at the end of the summer session.

16.2 A student is classified normal or as under probation according to the following;

1. Normal status applies to students who are registered in the very first session or students who have CUM-GPA of at least 2.00.
2. Probation status applies to students who have CUM-GPA greater than or equal to 1.50 but less than 2.00, which can be further classified into 2 types.

Type 1 means a group of students who have Cum-GPA of 1.50 or higher but less than 1.80.

Type 2 means a group of students who have Cum-GPA of 1.80 or higher but less than 2.00.

Rule 17: Student's level

A student's level is classified from the total number of credits that the student has earned out of the total number of credits in the curriculum.

Rule 18: Student status will not be maintained according to the following conditions;

18.1 The student has completed the program of study according to the curriculum and has been approved to receive a diploma or a bachelor's degree under Rule 20.

18.2 The student has been approved from the Dean to be dismissed.

18.3 The president orders the student to be dismissed according to the following situations;

1. After classification, the student has CUM-GPA less than 1.50.
2. The student is under type 1 probation having CUM-GPA less than 1.80 and is still under probation in the next 2 semesters or the next 3 trimesters continuously or for one academic year by Rule 5.3.
3. The student is under type 2 probation having CUM-GPA less than 2.00 and is still under probation in the next 4 semesters or the next 6 trimesters continuously or 2 academic years by Rule 5.3.
4. The student registers in the same course at the maximum number of times stipulated in Rule 9.2(3) and still does not pass the course.
5. The student has used twice the time specified in the curriculum.



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6. No registration or no leave of absence request has been made after the first two weeks of the session. The university cannot contact the student and the student has no appropriate reason to explain the situation.
7. The student acts against the university or joint institute regulations on students' discipline.
8. The student has difficulty with studying or working due to mental disorders. In this case, the university will appoint a committee to deliberate on the situation and make recommendations for the university council's approval.
9. The student is punished according to Rule 22.
10. Death.

Rule 19: Graduation

- 19.1 Graduation from full-time undergraduate study (4 years) can be made on or after the 6th regular semester.
- 19.2 Graduation from full-time undergraduate study (5 years) can be made on or after the 8th regular semester.
- 19.3 Graduation from full-time undergraduate study (not less than 6 years) can be made on or after the 10th regular semester.
- 19.4 Graduation for full-time undergraduate study (continuing) can be made on or after the 4th regular semester.

Rule 20: Granting Diploma or Bachelor's Degree

In order to be eligible to receive a Diploma or a Bachelor's Degree, a student has to;

- 20.1 Pass all courses and fulfill other criteria indicated in the curriculum.
- 20.2 Have CUM-GPA of at least 2.00
- 20.3 Have good behavior suitable for the prestige of the degree.

Rule 21: Degree with Honors

A student who has studied in an undergraduate program in the university with at least 120 credits including transferred courses, is eligible to receive a degree



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with honors. However, transferred courses require at least Grade B (or equivalent) and are not used to calculate the CUM-GPA. In order to receive Class 1 honors, the student must have a CUM-GPA of 3.50 or above, while a Class 2 honors student must have a CUM-GPA of 3.25 or above, also a student must;

21.1 Not used time that exceeds that which is indicated in the curriculum.

21.2 Be eligible to receive a degree according to Rule 20.

21.3 Never have re-graded or re-registered in other courses or re-taken an exam or re-done a report or project in any course in the curriculum including the transferred courses.

21.4 If the student has transferred some credits, the sum of the transferred credits should not exceed one quarter of the total number of credits in the curriculum.

Rule 22: Dishonesty Punishments

Cheating during the exam is punished as follows;

22.1 Given F on the course in which cheating is committed.

22.2 Given F on the course in which cheating is committed, and be suspended in the next session for at least one session.

22.3 Given F to all courses registered in that session.

22.4 Given F to all courses registered in that session and be suspended in the next session for at least one session.

22.5 Be dismissed.

The president has the right to dismiss a student who has cheated in the exam, and that student cannot be re-admitted to study at Mahidol University.

Rule 23: Any act that is not included in this regulation, regulations of other universities or faculties that conforms to this regulation may be adopted.

Rule 24: The president is in charge of these regulations. In case of any problems concerning these regulations, the president has the power to make diagnostic interpretation and issue a command as he deems appropriate.



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Announced on 27th April, 2009

(Professor Dr. Vicharn Panich, M.D.)

Chairman of Mahidol University Council



Mahidol University Regulations
on Diploma and Undergraduate Studies (2nd Issue), B.E. 2556 (2013)

Whereas it is deemed as appropriate to modify the Mahidol University Regulations on Diploma and Undergraduate Studies B.E. 2552 (2009).

Mahidol University Council, under Section 24 (2) of Mahidol University Act B.E.2550 (2007), agreed to enact the following regulations in its 478th meeting held on 20th November 2013.

1. These regulations are referred to as “Mahidol University Regulations on Diploma and Undergraduate Studies (2nd Issue), B.E. 2556 (2013).”
2. These regulations shall become effective after the promulgation date and henceforth.
3. The statement, hereby called Number 4 of Mahidol University Regulations on Diploma and Undergraduate Studies, 2009 shall be cancelled, and the following statement shall be applied.

“4. Each faculty committee shall consider admitting applicants into their programs in accordance with conditions and procedures stated in the curriculum or in the faculty announcements approved by the President of Mahidol University. The university shall determine the types of opening for undergraduate students which will be in the university announcement.”

4. The statement, hereby called Number 18.3 (6) of Mahidol University Regulations on Diploma and Undergraduate Studies, B.E. 2552 (2009) shall be cancelled, and the following statement shall be applied.

“18.3 The President shall expel a student in the following cases:

(6) within 2 weeks of registration, the student not registering for regular semester, not registering to retain student status, or not being approved for postponing the registration.

5. The following statement shall be added as Number 18/1 to Mahidol University Regulations on Diploma and Undergraduate Studies, B.E. 2552 (2009):

“18/1 Student status reinstatement

18/1.1 The student whose status ends due to Number 18.3 (6) may request reinstatement of student status by presenting the request form for reinstatement of student status to the President within 1 year after the expulsion.

18/1.2 Reinstatement of student status must be approved by the President following the consent of the Chairperson of the Program, the Dean, and Vice President for Education respectively.

18/1.3 After approval by the President, the student can earn student status and return to study regularly in the following semester.



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18/1.4 The duration of the study absence will be included in the duration of the program's maximum study period.

18.1.5 The student must pay the fee for the reinstatement of student status as well as the fees incurred during the period of the study absence.

18/1.6 After the return of student status is approved, the student will have his/her regular status as before. However, the computation of the study duration will be made according to Number 7.”

Announced on 16th December, 2013

(Professor Dr. Vicharn Panich)

Chairman of Mahidol University Council



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Mahidol University Regulations
on Diploma and Undergraduate Studies (3rd Issue), B.E. 2558 (2015)

Whereas it is deemed as appropriate to modify Mahidol University Regulations on the Bachelor's Degrees and the Diploma/Certificate Program B.E. 2552 (2009) and the additionally modified (2nd Issue) B.E. 2556 (2013).

Mahidol University Council, under Section 24 (2) of Mahidol University Act B.E. 2550 (2007), agreed to enact the following regulations in its 495th meeting on 22nd April, 2015.

1. These regulations are referred to as "Mahidol University Regulations on Diploma and Undergraduate Studies (3rd Issue), B.E. 2558 (2015)."

2. These regulations shall become effective from the promulgation date and henceforth.

3. The following statement, hereby called Number 23/1, is to be added to Mahidol University Regulations on on Diploma and Undergraduate Studies, B.E. 2552 (2009) and additionally modified (2nd Issue) B.E. 2556 (2013).

"Number 23/1: The University Council has the authority to consider cases for exemptions of the regulations provided that the cases have gained approvals from no less than a quarter of the council members presented in the meeting."

Announced on 20th May, 2015

(Professor Dr. Vicharn Panich

Chairman of Mahidol University Council



Mahidol University Regulations on Diploma and Undergraduate Studies (Issue 4), 2015

Mahidol University Regulations on Diploma and Undergraduate Studies was under consideration for improvement, and thus Mahidol University Council, under Section 24(2) of Mahidol University Act B.E.2550 (2007), agreed to enact the following regulations in its 500th meeting on 16th September 2015.

1. These regulations are referred to as “Mahidol University Regulations on Diploma and Undergraduate Studies (Issue 4), 2015.”

2. These regulations shall be effective from academic year of 2015 and henceforth.

3. The definitions of a “faculty” and a “faculty committee” stated in number 3 of Mahidol University Regulations on Diploma and Undergraduate Studies 2009 shall be cancelled, and the following statements shall be applied:

A “working unit” refers to a faculty, a college, an institute, a graduate school, and other working units, called by other terms that are responsible for teaching and are an equivalent to a faculty; this includes a campus with a curriculum/curricular complying with the university’s regulations.

A “working unit committee” is a term that covers other working unit committees or working units that are called by other terms and are responsible for teaching.

4. The statement in number 8.4 of Mahidol University Regulations on Diploma and Undergraduate Studies 2009 shall be cancelled, and the following statements shall be applied:

“8.4 An “F” grade shall be given to students with the following circumstances:

(1) students who have attended the examination and/or failed the examination or failed in an evaluation of their work

(2) students who have missed the examination despite not being allowed to by the faculty committee or the person authorized by the faculty

(3) students who have not been allowed to take the examination as stated in number 11

(4) students who have violated examination rules, such as showing up later than the indicated time, not following the dress code, or having performed an action as stated in number 22 and therefore it has been decided to fail them in the examination

(5) students who have received an “I” and have not proceeded with the examination or the assigned work after receiving an “I” within one normal academic year of the semester or the trimester system, except for those who have been allowed to drop the semester as stated in numbers 15.1 and 15.2

(6) students who have received a “P” and have not taken the examination and/or submitted the assigned work

(7) students who have not taken the re-examination or have not re-submitted the assigned work as stated in number 8.3 (2); or students who have taken the re-examination or re-submitted the work but still have failed the evaluation



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(8) students who lack the qualifications for the subject's evaluation as stated by the "working unit committee"

5. The statement in number 22 of Mahidol University Regulations on Diploma and Undergraduate Studies 2009 shall be cancelled, and the following statements shall be applied:

"22. Students who have cheated in the subject's examination shall get an "F" for that particular subject, and disciplinary actions shall be taken against each student according to the Mahidol University Regulations on Student Disciplines".

6. If the terms "faculty" and "the faculty committee" are used in the Mahidol University Regulations on Diploma and Undergraduate Studies 2009, they shall refer to a "working unit" and a "working unit committee" as stated in this announcement.

Announced on 15th October 2015

(Professor Dr. Vicharn Panich)

Chairman of Mahidol University Council



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Mahidol University Regulations on Diploma and Undergraduate Studies (Issue 5), 2016

Mahidol University Regulations on Undergraduate Studies were under consideration for improvement, and thus Mahidol University Council, under Section 24(2) of Mahidol University Act 2007, agreed to enact the following regulations in its 507th meeting on 20th April 2016.

1. These regulations are referred to as “Mahidol University Regulations on Diploma and Undergraduate Studies (Issue 5), 2016.”

2. These regulations shall be effective from the next day after the announcement.

3. The following statement shall be added as number 19/1 in the Mahidol University Regulations on Diploma and Undergraduate Studies 2009:

“19/1 English Proficiency Tests

Undergraduate students shall pass English proficiency test(s) according to the university’s conditions and regulations”

4. The following statement shall be added as number 20.4 in the Mahidol University Regulations on Diploma and Undergraduate Studies 2009:

“20.4 Students are able to pass the English proficiency test according to the university’s announcement.”

Announced on 30th May 2016

(Professor Dr. Vicharn Panich)

Chairman of Mahidol University Council



Mahidol University Regulations

on Diploma and Undergraduate Studies (Issue 6), 2017

Mahidol University Regulations for Diploma and Undergraduate Studies have been under consideration for improvement, and thus the Mahidol University Council, under section 24(2) of the Mahidol University Act of B.E. 2550 (2007), agreed to enact the following regulations in its 517th meeting on 15th February 2017.

1. These regulations are referred to as “Mahidol University Regulations for Diploma and Undergraduate Studies (Issue 6), 2017”.
2. These regulations shall be effective from the announcement date and henceforth.
3. Statement number 14 of the Mahidol University Regulations for Diploma and Undergraduate Studies 2009 shall be cancelled, and the following statements shall be applied:

“14 Credit Transfer

Students who wish to transfer credits from their subjects or their working units (within Mahidol University or from other higher education institutes) may request to transfer credits up to the number of credits that they are required to take to complete their program, without having to enrol in subjects in the program, and the results will be shown as “T”. The transfer can be made only after the students have obtained permission to do so, or for students who have been approved to enrol in subjects in other higher education institutes. Such conduct must be agreed by the lecturers responsible for the program, the working unit committee, or the program committee. The credit transfer must follow the following rules:

14.1 Conditions for credit transfer

(1) The credit(s) to be transferred must be of subject(s) in other higher education institutes in Thailand or overseas with a higher or equivalent standard to Mahidol University, and they must have been approved by the program committee.

(2) The credit(s) to be transferred must be of subject(s) that provide at least a three-quarter similarity or equivalent content and learning experiences to students compared to subjects in the program, and this must have been approved by the program committee.



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(3) The credit(s) to be transferred must be from subject(s) which the student has been enrolled in within 5 years. If not, the program committee and the working unit committee will consider the matter.

(4) The grade(s) of the credited subject(s) to be transferred must be at least a C.

(5) Students can transfer no more than half of the total number of credits in the program.

14.2 Students who wish to transfer their credits must send evidence regarding those subjects and a letter to the working unit. The head of the working unit, agreed by the relevant department and program committee and/or the working unit committee, is responsible for the credit transfer consideration and will present their findings to the Mahidol University President for approval.

14.3 The transferred credit(s) will be shown in the student's transcript under the name of the subject(s) transferred, marked with "T", and their scores will not be included in the GPA.

14.4 Students who have their credit transferred as stated in number 14.1 (1) – (3) can still obtain a bachelor's degree according to the Mahidol University Regulations for Diploma and Undergraduate Studies.

14.5 Credit transfer can be done under student exchange and student mobility projects between Mahidol University and other higher education institutes in a program or in an MOU, as detailed below:

(1) Bilingual programs that cooperate with overseas higher education institutes – Students will graduate with two bachelor's degrees, one from Mahidol University and another from the overseas institute;

(2) Double or multiple degree programs that cooperate with overseas higher education institutes – Students will graduate with two bachelor's degrees, one from Mahidol University and another from the overseas institute that cooperates in teaching in the program;

(3) Joint degree programs which are programs that cooperate in teaching with overseas institutes – Students will graduate with one bachelor's degree;

(4) Distance education programs with reliable planning, teaching methods, teaching services, and quality assessments; or



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(5) MOU between Mahidol University and overseas higher education institutes.

Concerning credit transfer in the cases of numbers 14.5 (1) - (5), students can obtain results for transferred credits as grades and they can be included in the GPA and be recorded on their transcripts. The head of the working unit, agreed by the relevant department and program committee and/or the working unit committee, is responsible for the matter consideration and present it to Mahidol University President for approval.

14.6 Any case of credit transfer other than those described in these regulations shall be considered by the head of the working unit, agreed upon by the relevant department and program committee and/or the working unit committee, and he or she will be responsible for presenting it to the Mahidol University President for approval.”

4. The credit transfer that has been made in MOU programs between Mahidol University and other overseas higher education institutes before the inauguration of these regulations shall follow number 14.5 in this announcement.

Announced on 1st March 2017

Prof. Emeritus Kasem Watanachai

Chairman of the Mahidol University Council



Mahidol University Regulations

on Diploma and Undergraduate Studies (Issue 7) 2017

(B.E. 2560)

Mahidol University Regulations on Diploma and Undergraduate Studies have been under consideration for improvement.

Thus, Mahidol University Council, under the Article 24 (2) of the Mahidol University Act B.E. 2550 (2007), agreed to enact the following regulations in its 525th meeting on October 18, 2017.

1. These regulations are referred to as “Mahidol University Regulations on Diploma and Undergraduate Studies (Issue 7) 2017 (B.E. 2560).”

2. These regulations shall be effective from the day after the announcement date and henceforth.

3. The statement in Clause 8.2 of Mahidol University Regulations on Diploma and Undergraduate Studies 2009 (B.E. 2552) shall be cancelled, and the following statements shall be applied:

“8.2 The symbols without grades

The outcome of the study for each course may be in the forms of certain symbols with the meaning as follows:

<u>Symbols</u>	<u>Meaning</u>
AU	Audit
O	Outstanding
S	Satisfactory
T	Transfer of Credit



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U	Unsatisfactory
I	Incomplete
P	In progress
X	No report
W	Withdrawal

4. The following clause shall be added as (3) of Clause 8.3 of Mahidol University Regulations on Diploma and Undergraduate Studies B.E. 2552 (2009):

“(3) The symbol O in each course signifies outstanding knowledge, ability, and skills or knowledge, ability, and skills that are above the normal criteria used for the assessment of each course.”

Announced on 28 November, 2017

Professor Emeritus Kraisit Tantisirin

Vice Chairman of Mahidol University Council

Acting Chairman of Mahidol University Council



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**Mahidol University Regulation on Diploma and Undergraduate Studies (8th issue)
B.E. 2561**

Mahidol University Regulation on Diploma and Undergraduate Studies has been deemed appropriate for a revision.

As empowered by the virtue of the Article 24 (2) of the Mahidol University Act B.E. 2550, Mahidol University Council, in the 531st meeting on April 18, 2018, announced the following statements.

1. This regulation is referred to as “Mahidol University Regulation on Diploma and Undergraduate Studies (8th issue) B.E. 2561.”

2. This regulation shall be enforced on the announcement date and henceforth.

3. The following statements shall be added as Clause 4/1 in Mahidol University Regulation on Diploma and Undergraduate Studies B.E. 2552.

“4/1 All students shall be supervised by appointed advisors who facilitates their educational planning according to their study plan. The Head of each work unit shall appoint instructors in all programs as advisors for all students of all years as stated in the first paragraph.

The advisors should meet their advisees according to the program’s requirements, and the advisors should set certain dates and time when their advisees can meet. All work units shall evaluate the advisors’ work every semester. The advisors shall be responsible for the following.

4/1.1 Giving advice and help their advisees plan their study that complies with the program’s requirements.

4/1.2 Giving advice about rules, regulations, and announcements in their study.

4/1.3 Giving advice about course registration, adding, dropping, and withdrawing and about their credits in each semester.

4/1.4 Giving advice about their studying and follow up on their study results.

4/1.5 Giving advice about how to process all matters in accordance with the University’s rules and regulations.

4/1.6 Giving advice about their advisees’ university life and education.

4/1.7 Making sure their advisees’ behaviors are appropriate in accordance with the University’s rules and regulations.

4/1.8 Reporting their consultation to the Head of the work unit every semester.

4/1.9 Being responsible for other assigned tasks.”

Announced on May 21, 2018

(Signature)

(Emeritus Professor Kraissid Tontisirin, MD., PhD)
Vice President of Mahidol University Council
and Acting President of Mahidol University Council



Mahidol University Announcement
on English Competence Standards for Undergraduate Students of Mahidol University 2017
(B.E. 2560)

Mahidol University agrees to set the English competence standards for undergraduate students of Mahidol University to be in accordance with the Announcement of the Office of Higher Education Commission Thailand on the Policy of the Improvement of the Standard of English Competency dated April 12, 2016, stating that institutions of higher education shall establish the policy and objectives to improve the standard of English ability in every program and every level of education of higher education institutions in order to serve as guideline for developing the English skills and abilities of undergraduate students and enable them to become graduates who have knowledge and abilities both in terms of academic, professional, and English communication skills, as well as to develop a plan to achieve the goals set in the policy, with the objectives and their indicators, as well as a clear system of evaluation.

As empowered by the virtue of the Article 19/1 of Mahidol University Regulations on Diploma and Undergraduate Studies (Issue 5) 2016 (B.E. 2559), in correspondence with the resolution of the 15/2017 meeting of Mahidol University Committee Board on 23 August, 2017, the President of Mahidol University issued This Announcement as follows:

1. The following announcements shall be cancelled

(1) Mahidol University Announcement on English Competence Standards for Undergraduate Students of Mahidol University 2017 (B.E. 2560), dated September 7, 2017

(2) Mahidol University Announcement on English Competence Standards for Undergraduate Students of Mahidol University 2017 (B.E. 2560), dated October 25, 2017

2. All undergraduate students of Mahidol University must meet the standard of English competency equivalent to the average English competency of students based on the Common European Framework of Reference for Languages (CEFR), and in accordance with the National Education Plan B.E. 2560-2574 issued by the Ministry of Education as follows:

2.1 an MU-ELT score of 84 and higher, or

2.2 a TOEIC score of 600 and higher, or

2.3 a TOEFL IBT score of 64 and higher, or



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2.4 an IELTS score of 5.0 and higher

3. The MU-ELT test will be held by Mahidol University every semester.

4. Students can take an English competency test every semester prior to graduation and they have to submit the score according to Article number 2 of this announcement within two years after being accepted as an undergraduate student of Mahidol University, so that they can have opportunities to improve their English competency to meet the criteria set by the university before graduation.

5. The test fee for MU-ELT is 400 baht per test.

6. Undergraduate students must pass the criteria set for the English competency prior to their graduation. This is considered one of the requirements for the approval of an undergraduate degree as stated in Article number 20.4 of Mahidol University Regulations on Diploma and Undergraduate Studies (Issue 5) B.E 2559 (2016).

7. The President of Mahidol University is in position of authority over this Announcement. In case of any dispute, the judgment of the President shall be final.

This shall be effective for undergraduate students who enroll in Mahidol University from the academic year 2017 onwards.

Announced on 10 November, 2017

Prof. Banchong Mahaisavariya, M.D

Acting President of Mahidol University



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Disciplinary Measures 2010

To minimize constraints to study within the Mahidol University community, students are protected and bound by a set of social rules. These rules or codes of conduct provide a framework within which students' rights and freedoms can be exercised.

Mandated by Article 24 (2) of the Mahidol University Act, 2007, the 442nd meeting of Mahidol University Council on September 15, 2010 enacted the following measures.

1. These measures are hereby called the "Mahidol University Disciplinary Measures 2010".
2. These measures will be activated on the day of the announcement.
3. They override Mahidol University Disciplinary Measures 2004.
4. With regard to these measures,

"University" denotes Mahidol University.

"President" denotes President of Mahidol University.

"Department" denotes Faculty, College, Institute, Faculty of Graduate Studies, and also any provincial campus using the university curriculum.

"Chair" denotes Dean, Director of an institute, and also a Vice President who supervises a provincial campus under the university curriculum.

"Staff" denotes civil servants, employees, and university officials at Mahidol University who possess work permits.

"Student" denotes certificated, undergraduate and graduate students.

Chapter 1

Codes of Conduct

5. Students must maintain discipline and ethical values. They should abide by any university/department announcements and follow the measures outlined.

6. Students must uphold unity, peace, and the reputation of the university. They should not instigate or participate in any quarrels, physical assaults, or damage to university or the other property.



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7. Students must behave themselves. They must abstain from behavior that could demean themselves, others, or the reputation of the university.

8. Students must listen to instructions and warnings from instructors and staff and act accordingly.

9. Students must dress appropriately. They must conform to the dress code of their department. Upon entering a class, an examination, or a department within the university, students must make their identification cards available in case any instructor or staff needs to see them.

10. Students must not drink alcohol or use drugs (or any prohibited substance) while they are in the university (including the provincial campuses) or while they are wearing their university uniform.

11. Students who engage in the following misconduct will be subject to serious disciplinary violation:

- (1) Gamble or take part in gambling businesses, or support thereof
- (2) Use, possess, or sell illegal drugs
- (3) Steal, extort, cheat, embezzle, threaten, force, or rob the other or engage in corruption for financial gain
- (4) Possess or carry weapons or toxic substances that may endanger the lives or properties of others
- (5) Perform immoral or inappropriate sexual or public behavior that could affect the reputation of the university
- (6) Quarrel or cause physical harm that ensues a severe injury or death or an adverse effect on the university's reputation
- (7) Commit a crime with the final court decision of imprisonment, except for mistakes made by carelessness
- (8) Intentionally cheat in an exam or make an effort to take part in an exam dishonestly
- (9) Produce, circulate, or possess media, publications, drawings, or writings or act in other ways to defile the other or the university
- (10) Forge a signature, fake a document, or change details in the original document, or file a document that has been adjusted to the university or the other entities that could result in damage to the university or the other
- (11) Willingly ruin university properties or those belonging to other
- (12) Act in a manner that the President determines as violating the codes of conduct

12. Students who carry out any of the misdeeds listed above will be subject to disciplinary punishment. For minor misdemeanors, the departmental chair may omit punishment and instead give the student verbal warning.

13. There are six (6) main types of disciplinary punishment.

- (1) Verbal warnings
- (2) Written warnings
- (3) Dismissal from examination



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- (4) Cancel, reconsider, or suspend the student's candidacy for a degree or a diploma
- (5) Withdraw for study up to one academic year
- (6) Dismiss the student from the university

14. Students who are considered as not severely violating the codes of conduct will be on the condition of written promise to behave appropriately. Verbal warnings of misconduct will be administered in cases where the violation is minor or there is a good reason for applying a reduced form of punishment.

15. Students who severely violate the codes of conduct will be subject to dismissal from an examination, degree cancellation, degree reconsideration, suspension of degree, withdrawal for up to one academic year, or dismissal from the university.

16. The departmental chair has the right to make departmental announcements regarding disciplinary measures - as long as the announcements are consistent with, and supplementary to, these existing measures and that they notify the university of their announcements.

Chapter 2

Disciplinary Proceeding

17. For cases with sufficient evidence, investigations and disciplinary punishments will be conducted promptly and fairly.

18. The investigation of the accused student will be performed by the Jury Council as appointed by the President or the departmental chair. This step can be skipped for the cases already settled as follows:

- (1) The court makes a judgment on the case, resulting in imprisonment or heavier penalties, except for minor misdemeanors, such as those caused by carelessness.
- (2) The student who conducted a wrongdoing confessed in person or in writing to the departmental chair or the Jury Council and the confession was recorded in writing.

19. The Jury Council in item 18 consists of at least 3 people including a President, a Secretary, and Jury(s). An investigation is carried out as early as possible and within 60 days from the date of the Jury Council appointment. If the investigation cannot be finished within the time period, the Jury Council can submit to the authority who appointed them for a maximum extension of 30 days for each submission.

20. The Jury Council must notify the accused person of his or her charges with the available supportive evidence. The name(s) of the witness(es) may or may not be disclosed. This information will allow the accused person to bring to the jury his or her witness(es) and testimonies prior to judgment decision.

21. For minor cases, the departmental chair may give verbal warnings or in writing as they consider appropriate, then notify the university of the incident as soon as possible.



22. For severe cases, departmental chair will report the causes and investigation results to the President for a decision regarding punishment. Depending on severity of the case, they will then proceed to dismiss the student's right of taking an exam, cancel, reconsider, or suspend their degree, or withdraw the student for a maximum of one (1) academic year, or dismiss the student from the university. Withdrawal from the university that the President may order a departmental chair to carry out on his behalf shall be for a maximum of one (1) semester.

23. Disciplinary punishments must be carried out following a formal letter of order. The authority must also provide information about making an appeal and the length of time allowed for this. Depending on the case, once punishment is delivered, the student's parent or guardian, adviser, and the university will be notified.

Chapter 3

Appeal

24. If a student is subject to a disciplinary punishment and does not accept it, the student has the right to appeal according to the procedures outlined here. During the appeal process, the student will still be subject to punishment.

25. The student who makes an appeal must file a signed formal document. Each individual can only appeal for themselves. A student cannot make an appeal on behalf of another student.

26. To support an appeal, the student can ask to check or make a copy of the past investigation record. The record of witness investigations and other documents may or may not be disclosed depending on judgment of the departmental chair or the Jury Council.

27. The Appeal Committee comprises of 5 to 7 people, one of which must be a paralegal professional or a law graduate appointed by the President with a specified operation period.

28. The Appeal Committee will perform the following tasks;

- (1) Analyze the appealed matter;
- (2) Make a written request for additional documents or visits from a person involved in the case as considered necessary;
- (3) Appoint a person or a group of people to make a consideration or to operate on a duty within the committee scope; and
- (4) Carry out other responsibilities designated by the university.

29. An appeal must be made to the Appeal Committee within fifty (50) working days starting from the first day that the accused student knows or should know about his or her punishment.

30. An appeal must be made directly to the Appeal Committee. The Committee must finish working on a case within thirty (30) days beginning from the day of the appeal being filed. The length of time for a case consideration may be extended no longer than sixty (60) days from the last of the given thirty (30) days. Written reports and records of the appeal must be made.

31. The Appeal Committee may render the punishment either appropriate or unjust. The Committee will then make a proposal to the President to either immediately dismiss the appealed case, increase, or reduce the punishment. The first deliberation of the Appeal Committee is final. The Committee must immediately pass the deliberation onto the student who made the appeal.



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32. To count the exact number of days for these measures, if the end of the period takes place on the weekend, the next working day will be considered as the end.

34. The President acknowledges these measures. When any problem arises regarding compliance with these measures, the President has the power to order an action and his word is final.

Chapter 4

Provisional Clauses

35. Any disciplinary proceedings or appeals that took place prior to the enactment of these measures shall comply with Mahidol University Disciplinary Measures 2004.

36. Until new appointments are made, the appointed body for the Mahidol University Disciplinary Measures 2004 will continue to act in its duty and in compliance with the details in Mahidol University Disciplinary Measures 2010.

Announced on October 8, 2010

**Prof. Wijarn Panich, M.D.
Chairman of Mahidol University Council**



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Faculty of Science, Mahidol University Announcement
Subject:
Undergraduate Education B.E. 2553 (2010)

Whereas it is deemed appropriate to define the criteria of undergraduate education to comply with the Mahidol University Regulation on Undergraduate and Diploma Education B.E. 2552 (2009).

Under the provisions of the Mahidol University Regulations on Diploma and Undergraduate Education B.E. 2552 (2009), the Dean of Faculty of Science, by the agreement of the Faculty Committee in its 4/2553 meeting on 7th April 2010, the criteria for undergraduate education has been stipulated as follows:

1. The following regulations and announcements shall be repealed:

1.1 Faculty of Science, Mahidol University Regulations on Education Assessment B.E. 2543 (), Dated 12th May B.E. 2543 (2000)

1.2 Faculty of Science, Mahidol University Regulations on Education Assessment (No. 2) B.E. 2545, Dated 9 January B.E. 2545 (2002)

1.3 Faculty of Science, Mahidol University Announcement, Subject: Criteria and Procedures of Re-examination for Undergraduate Students B.E. 2547, Dated 20th May B.E. 2547 (2004)

1.4 Faculty of Science, Mahidol University Announcement, Subject: Criteria and Procedures of Re-examination for Undergraduate Students B.E. 2547 (Addendum), Dated 15th March B.E. 2550 (2007)

2. In this announcement,

“Faculty” means the Faculty of Science, Mahidol University.

“Dean” means the Dean of Faculty of Science, Mahidol University

“Students” means the undergraduate students of Faculty of Science, Mahidol University, and students enrolled in the subjects provided by the Faculty of Science, Mahidol University.

3. First and Second Semesters are normal mandatory semesters, and students must register their subjects and credits as required by the Faculty of Science, which required at least 9 credits and no more than 23 credits for each normal semester.

4. For subjects with prerequisite(s), the students must be evaluated as “pass” in the prerequisite subjects(s) before they can register for the subject. Except when the requisite and the subject are offered in the same year.



-
5. Students cannot take 2 subjects which are offered at the same date and time.
 6. To evaluate students in more detail, the (+) mark was employed, meaning there will be B+, C+, and D+. The required score and the meaning of the mark would follow the regulations stipulated by the university.
 7. The A, B+, B, C+, C, D+, D, S, T, and AU are evaluated as “pass”, while F and U are evaluated as “not pass”.
 8. In cases where the student has to be absent with a cause, the student must submit the examination rescheduling before the exam or within 3 days after the exam to the Educational Affair Division and the penalty of 30% score. Rescheduling without penalty require the consideration of the committee of no less than 3 persons which include the executive of the Educational Affair Division and lecturers of the department.
 9. Summer is not a mandatory semester. The Faculty of Science will not offer classes during summer semester, EXCEPT for subjects in which the students received F grade in the first or second semester or have more than 15 accumulated students with the F grade. For subjects with less than 15 accumulated students, the respective department shall arrange a re-examination of the subject(s) during the summer semester, and no course(s) will be offered during the summer semester.
 10. If other condition applies, the offer of summer subject(s) shall be considered by the Deputy Dean for Education.
 11. Students eligible to register in summer semester include:
 - 11.1 Students with the mark F in the subject offered during the summer semester or
 - 11.2 Students with GPA lower than 2.00 or
 - 11.3 Students approved by the department responsible for the subject offered.Students must not have been evaluated as Dismissed or prone to being dismissed. In cases that the student has already registered for the subject, but the GPA fell into Dismissed classification, the registration shall be considered void.
 12. Students eligible to register for the re-examination include students who had received the F mark in the subject(s) which are open for re-examination in the same year as the opened subject(s).

Students must not have been evaluated as Dismissed or prone to being dismissed. In cases that the student has already registered for the subject, but the GPA fell into Dismissed classification, the registration shall be considered void.
 13. Classes in summer semester last for 6 weeks, with the final examination on the 7th week, and the evaluation completed in the 8th week. The maximum credits for the summer semester is 9 credits, and the subjects can be withdrawn within 4 weeks after the class started.



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14. The re-examination of the subjects in either the first or the second semester will be held at least 4 weeks after the announcement of the second semester's final results. This is to allow the students to prepare for the examination and submit the re-examination request. The latest grades of the students must also be submitted to the Educational Affair Division within 8 weeks after the announcement of the final examination results, and no re-examination is permitted beyond the given time.

15. The re-examination grade can only be D or F. Except the re-examination of 2nd or 3rd year students of the Faculty of Medicine Ramathibodi Hospital, Bangkok Medical College and Vajira Hospital, Maharat Nakhon Ratchasima Hospital Medical Education Center, Sawanpracharak Hospital Medical Education Center, and Maharaj Nakhonsithammarat Hospital Medical Education Center, which the re-examination grade can be D+, D, or F.

16. The Dean of Faculty of Science shall ensure the announcement is followed. Should any problem arise following this announcement, the Dean of Faculty of Science shall rule, consider, and make decision as deemed appropriate.

The announcement shall be in effect from 1 June B.E. 2553 (2010).

Announcement made on 11 May B.E. 2553 (2010)

(Prof. Dr. Skorn Mongkolsuk)
Dean
Faculty of Science
Mahidol University



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Appendix 8

Order of Curriculum Development Committee
or Curriculum Screening Procedure Committee or Person In-charge



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คำสั่งคณะกรรมการพัฒนาหลักสูตรระดับปริญญาตรี
 ที่ ๑๖๙/ ๒๕๖๒
 เรื่อง แต่งตั้งคณะกรรมการพัฒนาหลักสูตรระดับปริญญาตรี
 สาขาวิชาวัสดุศาสตร์และวิศวกรรมนาโน (หลักสูตรนานาชาติ)
 หลักสูตรปรับปรุง ปีการศึกษา ๒๕๖๒

เพื่อให้การดำเนินการพัฒนาหลักสูตรวิทยาศาสตร์บัณฑิต สาขาวิชาวัสดุศาสตร์และวิศวกรรมนาโน (หลักสูตรนานาชาติ) หลักสูตรปรับปรุง ปีการศึกษา ๒๕๖๒ เป็นไปด้วยความเรียบร้อยและมีประสิทธิภาพ อาศัยอำนาจตามความในมาตรา ๓๗ แห่งพระราชบัญญัติมหาวิทยาลัยมหิดล พ.ศ.๒๕๕๐ คณะบดีจึงออกคำสั่งแต่งตั้งคณะกรรมการพัฒนาหลักสูตรวิทยาศาสตร์บัณฑิต สาขาวิชาวัสดุศาสตร์และวิศวกรรมนาโน (หลักสูตรนานาชาติ) หลักสูตรปรับปรุง ปีการศึกษา ๒๕๖๒ ดังรายนามต่อไปนี้

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|----------------------------------|----------------------|
| ๑. ผศ.ดร.รักษชาติ ไตรผล | ประธานกรรมการ |
| ๒. รศ.ดร.ประณัฐ โพธิยะราช | กรรมการผู้ทรงคุณวุฒิ |
| ๓. นางสาว อิตารัตน์ งามสุวัฒน์ | กรรมการผู้ทรงคุณวุฒิ |
| ๔. อ.ดร.พงศกร กาญจนบุษย์ | กรรมการ |
| ๕. ผศ.ดร.เดิมนักดิ์ ศรีศิริพันธ์ | กรรมการ |
| ๖. อ.ดร.กิตติทัศน์ สุบรรณจ้อย | กรรมการและเลขานุการ |

หน้าที่

๑. ดำเนินการพัฒนาหลักสูตรให้แล้วเสร็จตามกำหนด โดยจัดทำรายละเอียดของหลักสูตร รายละเอียดของรายวิชา และรายละเอียดของประสบการณ์ภาคสนาม (ถ้ามี) ให้ชัดเจนตามกรอบมาตรฐานคุณวุฒิระดับอุดมศึกษาแห่งชาติและนโยบายของมหาวิทยาลัย
๒. กำหนดการประกันคุณภาพภายในของหลักสูตร เช่น กำหนดตัวบ่งชี้และเกณฑ์การประเมินผลการดำเนินงาน ฯลฯ
๓. ประสานงานกับงานการศึกษา และกองบริหารการศึกษา เพื่อขอความเห็นชอบจากคณะกรรมการที่เกี่ยวข้อง ตามขั้นตอนการพิจารณาหลักสูตร

ทั้งนี้ ตั้งแต่บัดนี้เป็นต้นไป โดยสิ้นสุดภาระหน้าที่เมื่อสภามหาวิทยาลัยอนุมัติการพัฒนาหลักสูตร

สั่ง ณ วันที่ ๑๙ พฤศจิกายน พ.ศ. ๒๕๖๒

(รองศาสตราจารย์ ดร.สิทธิวัฒน์ เลิศศิริ)
 คณบดีคณะวิทยาศาสตร์



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คำสั่งคณะวิทยาศาสตร์ มหาวิทยาลัยมหิดล

ที่ ๙๘๗ / ๒๕๖๑

เรื่อง แต่งตั้งคณะกรรมการพิจารณาถ้อยแถลงของหลักสูตรวิทยาศาสตร์บัณฑิต

ด้วยมีกรรมการบางท่านแจ้งความประสงค์ขอลาออกจากการเป็นคณะกรรมการพิจารณาถ้อยแถลงของหลักสูตรวิทยาศาสตร์บัณฑิต อาศัยอำนาจตามความในมาตรา ๓๗ แห่งพระราชบัญญัติมหาวิทยาลัยมหิดล พ.ศ. ๒๕๕๐ คณะบดีจึงยกเลิกลำดับคำสั่งคณะวิทยาศาสตร์ มหาวิทยาลัยมหิดล ที่ ๖๖๔/๒๕๖๑ ลงวันที่ ๒๙ สิงหาคม พ.ศ. ๒๕๖๑ เรื่อง แต่งตั้งคณะกรรมการพิจารณาถ้อยแถลงของหลักสูตรวิทยาศาสตร์บัณฑิต และให้แต่งตั้งคณะกรรมการพิจารณาถ้อยแถลงของหลักสูตรวิทยาศาสตร์บัณฑิต ดังรายนามต่อไปนี้

- | | |
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| ๑. ศาสตราจารย์ ดร.สุมาลี ตั้งประดับกุล | ที่ปรึกษา |
| ๒. รองคณบดีฝ่ายการศึกษาและพัฒนาคุณภาพ | ประธานกรรมการ |
| ๓. รองคณบดีฝ่ายแพทยศาสตร์และบัณฑิตศึกษา | รองประธานกรรมการ |
| ๔. รองคณบดีฝ่ายบริการการศึกษา ศาลายา | รองประธานกรรมการ |
| ๕. ผู้ช่วยคณบดีฝ่ายการศึกษา | รองประธานกรรมการ |
| ๖. รองศาสตราจารย์ ดร.กิตติศักดิ์ หยกทองวัฒนา | กรรมการ |
| ๗. ผู้ช่วยศาสตราจารย์ ดร.ขวัญ อารยะธนิกุล | กรรมการ |
| ๘. ผู้ช่วยศาสตราจารย์ ดร.ไพโรจน์ สติระคู | กรรมการ |
| ๙. ผู้ช่วยศาสตราจารย์ ดร.มันทนา จรียาบูรณ์ | กรรมการ |
| ๑๐. ผู้ช่วยศาสตราจารย์ ดร.ศศิวิมล แสงวงผล | กรรมการ |
| ๑๑. ผู้ช่วยศาสตราจารย์ ดร.สุพิชา คุ่มเกตุ | กรรมการ |
| ๑๒. หัวหน้างานการศึกษา | กรรมการ |
| ๑๓. นางสาวสายพิน ทองพั๊ด | กรรมการและเลขานุการ |
| ๑๔. นางสาวเมธาวี กาจจุลศรี | กรรมการและผู้ช่วยเลขานุการ |

อำนาจหน้าที่

- พิจารณาถ้อยแถลงของหลักสูตร ให้ความเห็น และข้อเสนอแนะเกี่ยวกับหลักสูตรที่เสนอเปิดใหม่ และหลักสูตรปรับปรุง ในระดับปริญญาตรี คณะวิทยาศาสตร์ รวมถึงตรวจสอบและกำกับคุณภาพของหลักสูตรให้เป็นไปตามเกณฑ์มาตรฐานหลักสูตรระดับปริญญาตรี พ.ศ.๒๕๕๘ และสอดคล้องกับนโยบายของมหาวิทยาลัย
- ปฏิบัติหน้าที่อื่นตามที่ได้รับมอบหมายจากคณบดีคณะวิทยาศาสตร์ มหาวิทยาลัยมหิดล

ทั้งนี้ ตั้งแต่บัดนี้เป็นต้นไป

สั่ง ณ วันที่ ๑๘ ธันวาคม พ.ศ.๒๕๖๑

ศาสตราจารย์ ดร.สิทธีวัฒน์ เลิศศิริ

(รองศาสตราจารย์ ดร.สิทธีวัฒน์ เลิศศิริ)
 คณบดีคณะวิทยาศาสตร์



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Appendix 9

MOUs documents made with agencies inside and outside Thailand (if any)



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MEMORANDUM OF UNDERSTANDING (MOU)

Between

UNIVERSITY OF TECHNOLOGY SYDNEY

and

MAHIDOL UNIVERSITY



Degree Bachelor Master Doctoral
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THIS MEMORANDUM OF UNDERSTANDING is made BETWEEN:

UNIVERSITY OF TECHNOLOGY SYDNEY (ABN 77 257 686 961) of 15 Broadway, Ultimo, New South Wales, 2007 Australia

("UTS")

AND:

MAHIDOL UNIVERSITY, Office of the President 999 Phuttamonthon 4 Road, Salaya, Phuttamonthon, Nakhon Pathom 73170 Thailand

("MU")

RECITALS

- A. The University of Technology, Sydney, Australia is a tertiary institution and body corporate established under the *University of Technology, Sydney Act 1989* (NSW). UTS has strong links to industry, the professions and the community and has a growing research reputation and a strong commitment to internationalisation.
- B. The parties wish to enter into this MOU to promote cooperation between them and to strengthen innovative collaboration in mutually acceptable fields of teaching, learning and research.

NOW THE PARTIES AGREE AS FOLLOWS -

1. Interpretation

- 1.1 In this MOU unless the context otherwise requires or the contrary intention appears, the following terms will have the meanings assigned to them –

Affiliate has the meaning set out in Item 1 of Schedule A.

Australian Sanctions Law means any Australian law under which sanctions are imposed on specified individuals, entities or countries, including each of the *Charter of the United Nations Act 1945* (Cth) and the *Autonomous Sanctions Act 2011* (Cth), the *Autonomous Sanctions Regulations 2011* (Cth), the *Anti-Money Laundering and Counter-Terrorism Financing Act 2006* (Cth), the *Anti-Money Laundering and Counter-Terrorism Financing Regulations 2008* (Cth) and the *Anti-Money Laundering and Counter-Terrorism Financing Rules*.

Date of Execution means the date on which this MOU is signed by the parties, as noted on the execution page at the end of this MOU.

Defence Trade Controls Law means any Australian law restricting or regulating the export, transfer or trading of specified defence-related or weapons-related goods, services or technologies, including each of the *Defence Trade Controls Act 2012* (Cth), *Customs Act 1901* (Cth), *Weapons of Mass Destruction (Prevention of Proliferation) Act 1995* (Cth), *Nuclear Non-Proliferation (Safeguards) Act 1987* (Cth) and *Chemical Weapons (Prohibition) Act 1994* (Cth).

Extension Period has the meaning set out in Item 4 of Schedule A.

Initial Term has the meaning set out in Item 3 and Item 4 of Schedule A.

MOU means this document and all schedules to this document.

Term means the term specified in clause 3.

- 1.2 A reference to a person includes a reference to corporations and other entities recognised by law.



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1.3 In this MOU, the headings to the clauses have been inserted for convenience of reference only and are not intended to be part of, or to affect the meaning or interpretation of any of the terms and conditions of this MOU.

1.4 The singular includes the plural and vice versa.

1.5 Words importing one gender will include a reference to all other genders.

2. Purpose of MOU

2.1 The purpose of this MOU is set out in Item 2 of Schedule A.

3. Term

3.1 This MOU will commence on the Date of Execution, and continue for the Initial Term unless terminated earlier in accordance with clause 10. The parties may extend this MOU for a further Extension Period by written agreement.

4. Further Agreements

4.1 The parties may enter into binding agreements, from time to time, with regard to any specific project.

4.2 A binding agreement resulting from this MOU may contain the matters set out in the schedule to this MOU.

4.3 Both parties acknowledge and understand that all financial arrangements, if any, will be subject to negotiation and prior written agreement and that any binding agreement will be subject to the availability of funds.

5. Privacy

5.1 The parties acknowledge that UTS is an authority bound by the *Privacy and Personal Information Protection Act 1998* (NSW) ("the Act") and the parties hereby will comply with the provisions of the Act in respect to any of its students, staff or research connected to this MOU.

6. Public Statements

6.1 Each party will ensure that before any public statements (including statements to the media or articles relating to their joint activities) are released or published that the prior written consent of the other party is obtained.

7. Name or Logo

7.1 No party will have the right to use the name or logo of another party without that party's prior written consent and other conditions attached to such consent.

8. Sanctions and defence trade controls

8.1 Each party warrants that:

(a) it is not a 'designated person or entity' for the purposes of an Australian Sanctions Law; and

(b) unless a party has informed the other party otherwise in writing, that party is not, and has not been, a citizen or resident of, or otherwise connected with, a country in respect of which sanctions apply under an Australian Sanctions Law.



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8.2 If a party ("the first party") determines, acting reasonably and after conducting any necessary investigations, that the other party is or may be exposed to a risk of breaching an Australian Sanctions Law or Defence Trade Controls Law as a result of any activity referred to in or contemplated by this MOU, the first party may, at its absolute discretion:

(a) require the other party to comply with any reasonable directions issued by the first party in order to mitigate the risk, including a direction to cease undertaking the activity; or

terminate this MOU, which termination will take effect immediately upon the first party notifying the other party.

9. No Relationship

9.1 The parties agree that this MOU does not create or evidence a relationship between them of commercial partnership, joint venture, employer and employee or agency.

10. Termination

10.1 Subject to existing contractual arrangements, this MOU may be terminated by either party giving written notice to the other party to this MOU. The length of this notice period is set out in Item 6 of Schedule A.

10.2 By signing this MOU neither party intends to enter into a legally binding relationship or be bound by this MOU. The parties only intend that this MOU provide a framework that outlines the major areas within which co-operation will proceed.

11. Notices and Communication

11.1 All communication and notices between the parties regarding this MOU may be made through the nominated representatives set out Item 6 of Schedule A, or such other persons they may nominate from time to time.

12. Governing Law

12.1 The parties agree that they shall endeavor to settle any dispute relating to this MOU by negotiating with each other in good faith. If the parties are unable to resolve completely the dispute through negotiation, the parties agree that any disputes between them shall be governed by the law of, and shall be subject to the exclusive jurisdiction of the country of domiciles of the defendant to the action.

13. Costs

13.1 Each party must pay its own costs of and incidental to the negotiation, preparation and execution of this MOU.

14. Execution and Counterparts

14.1 This MOU may be signed in counterparts, each of which is deemed to be an original and all of which constitute one and the same instrument.

14.2 The parties agree that if this MOU is not executed by both parties on the same date, this MOU will commence on and from the later Date of Execution.

14.3 The parties will execute copies of this MOU with each party retaining an original copy.



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15. Entire MOU

- 15.1 This MOU constitutes the entire MOU between the parties. Any prior arrangements, agreements, warranties, representations or undertakings with respect to the Purpose of this MOU are superseded.



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SCHEDULE A – MOU DETAILS

- Item 1. Name of Affiliate:** Mahidol University
Address: 999 Phuttamonthon 4 Road, Salaya
Phuttamonthon
Nakhon Pathom 73170
Thailand
- Item 2. Purpose of this MOU**
To promote co-operation between the Mahidol University and the University of Technology Sydney (UTS) and encourage direct contact and co-operation between their faculty and administrative staff, divisions and other units
- Item 3. Initial Term**
[5 years]
- Item 4. Extension Period**
[5 years]
- Item 5. Termination notice (clause 10)**
6 months
- Item 6. Address for notices**

UNIVERSITY OF TECHNOLOGY SYDNEY

Name/title of contact person:

Address: Mr Leo Mian Liu
Director, UTSI
15 Broadway, NSW 2007, Australia

Email: ir.partners@uts.edu.au

Telephone: +61 2 9514 8076

Fax number: +61 2 9514 1530

Affiliate

Name/title of contact person:

Address: Ms. Wanpimon Senapadpakorn
Director, International Relations Division
999 Phuttamonthon 4 Road, Salaya, Phuttamonthon,
Nakhon Pathom 73170 Thailand.

Email: opinter@mahidol.ac.th

Telephone +66 (0) 2849 6230
Fax number: +66 (0) 2849 6237



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EXECUTION PAGE


EXECUTED AS AN MOU ON THE DATES APPEARING BELOW

SIGNED for and on behalf of the **UNIVERSITY OF
TECHNOLOGY SYDNEY** (ABN 77 257 686 961)

this *27 Oct* day of 2015

by **Professor William Purcell**

Deputy Vice-Chancellor and Vice-President,
(International and Advancement)


.....
(signature)

SIGNED for and on behalf of MAHIDOL UNIVERSITY

this *2nd* day of *October* 2015

by **Professor Sansanee Chaiyaroj**
Vice President for Research and International
Relations


.....
(signature)



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ARTICULATION AGREEMENT

Between

**MAHIDOL UNIVERSITY
KINGDOM OF THAILAND**

And

**UNIVERSITY OF TECHNOLOGY SYDNEY
AUSTRALIA**



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Code	means the Australian National Code of Practice for Registration Authorities and Providers of Education and Training to Overseas Students provided for under the ESOS Act as amended from time to time.
Commencement Date	means the date specified in clause 2.2.
Confidential Information	means information that is by its nature confidential or is designated by one of the parties as confidential or any of the parties knows or ought to know is confidential, including without limitation, any confidential operations, processes or inventions carried on or used by the parties, technology, designs, documentation, manuals, budgets, course or subject evaluations, financial statements or information, accounts, drawings, notes, memoranda and the information contained therein and any other information relevant to the organisation, business, finances or affairs of any of the parties or any personal information of the students applying for or enrolled in the Articulation Program.
Confirmation of Enrolment	means UTS confirmation of enrolment confirming that an Eligible Student has accepted a Letter of Offer from UTS.
CRICOS	means the Australia Commonwealth Register for Institutions and Course for Overseas Students.
Defence Trade Controls Law	means any local or international law restricting or regulating the export, transfer or trading of specified defence-related or weapons-related goods, services or technologies.
Eligible Student	means a MU student who meets the entry requirement to the UTS undergraduate degree programs under the Articulation Program as described in clauses 3.1 and 3.2.
ESOS Act	means the <i>Education Services for Overseas Students Act 2000</i> (Commonwealth of Australia), as amended from time to time.
Intellectual Property Rights	means all statutory and other proprietary rights, Confidential Information, copyright, trademarks, designs (as embodied in, but not limited to, drawings, computer software, solid models and computer algorithms), patents, circuit layouts and all other rights arising from or capable of arising from: the <i>Circuit Layouts Act 1989</i> (Cth); the <i>Copyright Act 1968</i> (Cth); the <i>Designs Act 1906</i> (Cth); the <i>Patents Act 1990</i> (Cth); the <i>Trademarks Act 1995</i> (Cth); any similar legislation within or outside the Commonwealth of Australia and/or any similar unregistered right.



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Letter of Offer	means a UTS letter of offer to a student applying to study at UTS and includes approved subject selection.
Sanctions Law	means any local or international law under which sanctions are imposed on specified individuals, entities or countries.
Term	means the term specified in clause 2.1
UTS Admissions Policy	means the UTS policy for admission to all courses offered by the university, other than short courses and which can be accessed at http://www.gsu.uts.edu.au/policies/admissions.html
UTS Credit Recognition Policy	means the UTS policy for granting credit to students for their previous learning, including the types of learning that may be recognised, the processes UTS uses, and the types of credit that can be granted and which can be accessed at http://www.gsu.uts.edu.au/policies/credit-recognition.html
UTS Rules, Directives and Policies	means the UTS Student and Related Rules, UTS General Rules and UTS Policies and Directives which can be accessed at http://www.gsu.uts.edu.au/lrp.html

- 1.2. reference to a person includes a reference to corporations and other entities recognised by law.
- 1.3. In this Agreement, the headings to the clauses have been inserted for convenience of reference only and are not intended to be part of, or to affect the meaning or interpretation of any of the terms and conditions of this Agreement.
- 1.4. The singular includes the plural and vice versa.
- 1.5. Words importing one gender will include a reference to all other genders.
- 1.6. A reference to a clause, schedule or attachment is a reference to a clause, schedule or attachment to this Agreement and includes any amendments to them made in accordance with this Agreement.



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- 1.7. Where under or pursuant to this Agreement the day on or by which any act, matter or thing is to be done is not a Business Day, such an act, matter or thing may be done on the next Business Day.

2. COMMENCEMENT AND TERM

- 2.1. This Agreement will commence on the date that the Agreement is signed by the parties and will continue for a period of 5 years unless earlier terminated in accordance with clause 15.
- 2.2. If this Agreement is not executed on the same date by the parties, then this Agreement will commence on the later dates of signing.
- 2.3. This Agreement may be executed in counterparts, each counterpart is deemed to be an original and all of which constitute one and the same instrument.

3. ARTICULATION PROGRAM

- 3.1. The Articulation Program is an arrangement between the parties which enables MU students who:
- (a) are enrolled with MU at the time of application to UTS; and
 - (b) have successfully completed 2 semesters of the undergraduate program(s) offered at MU with a GPA of 2.5/4 as specified in Appendix 1; and
 - (c) meet the UTS English language requirements as outlined on the UTS website at: <http://www.uts.edu.au/international/prospective/studying/require/english.html>; and
 - (d) are not prohibited under local or international legislation including the Australian Sanctions Law or United Nations sanctions regime from participating in the Program, to apply for admission to the UTS undergraduate degree programs under the terms and conditions of this Agreement.
- 3.2. MU students who meet the requirements set out in clause 3.1 are Eligible Students under this Agreement and will be granted credit points as specified in Appendix 1 by UTS towards the UTS undergraduate degree program
- 3.3. The UTS undergraduate degree program will be delivered by UTS in Sydney, Australia.
- 3.4. MU will recognise the credits obtained by MU students upon successful completion of the UTS undergraduate degree programs for credit transfer to MU undergraduate programs as specified in Appendix 1.
- 3.5. The approved credit recognition arrangement between UTS and MU is governed by the terms and conditions in this agreement only and does not apply to any other credit recognition arrangements.



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- 3.6. In case the defence for the MU undergraduate program(s) takes place at UTS, it will be organized by MU and assisted by UTS.

4. ADMISSION TO UTS UNDERGRADUATE DEGREE PROGRAM

- 4.1. Eligible Students must apply to UTS for admission to the undergraduate degree program in accordance with UTS international student policies and procedures.
- 4.2. Eligible Students who receive a Confirmation of Enrolment from UTS must:
- (a) obtain all immigration and travel clearances that may be required for study within Australia including overseas student health cover; and
 - (b) meet any other criteria that may be agreed by the parties in writing.

5. UTS OBLIGATIONS

- 5.1. UTS will provide the MU with sufficient and up to date information to enable the MU to promote the UTS undergraduate degree programs.
- 5.2. UTS will provide marketing material about UTS and the UTS undergraduate degree programs to MU to facilitate all briefing and induction for prospective and enrolled students of the Articulation Program.
- 5.3. UTS will be responsible for updating MU on any amendment to the UTS undergraduate degree programs or credit recognition that may affect the Articulation Program.
- 5.4. UTS will be responsible for processing Eligible Students' applications and informing Eligible Students about their application outcomes at the earliest convenience.
- 5.5. The UTS undergraduate degree programs will be conducted in accordance with UTS Rules, Directives and Policies.
- 5.6. Eligible MU students admitted and enrolled at UTS are subject to all rules, policies and regulations of UTS, and have the same rights and responsibilities as all UTS students.

6. MU OBLIGATIONS

- 6.1. At its cost, MU will promote the UTS undergraduate degree programs to its students as an option for further study.
- 6.2. MU must:
- (a) assist its students to complete forms and applications required by UTS for admission to the UTS undergraduate degree programs;



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- (b) ensure MU students have enough information regarding international student visa applications and assist MU students to complete their international student visa applications;
 - (c) ensure MU students meet the genuine student requirements as set by the Australian Department of Immigration and Citizenship (further information at <http://www.immi.gov.au/students/pdf/2011-genuine-temporary-entrant.pdf>);
 - (d) ensure that all information provided to students or prospective students which relates to UTS and the UTS undergraduate degree programs is accurate and up to date;
 - (e) clearly identify UTS as the provider of the UTS undergraduate degree programs and include UTS's CRICOS code of 00099F in all written and other material including in electronic form;
 - (f) in promoting the UTS undergraduate degree programs, comply with, and ensure its employees, officers and agents observe and comply with, the ESOS Act and the Code;
 - (g) only undertake promotional activities which have been approved by UTS;
 - (h) only use promotional material that has been provided by UTS and has been approved in writing by UTS;
 - (i) not make statements or publish materials in relation to the UTS undergraduate degree programs which are inconsistent with the promotional materials approved by UTS;
 - (j) promote the UTS undergraduate degree programs with integrity and accuracy; and
 - (k) immediately amend or replace marketing materials as requested by UTS if such amendments or replacements are required by law, including without limitation, the ESOS Act or the Code.
- 6.3. MU must advise UTS from time to time of any changes related to the approved MU undergraduate program(s) curriculum and or course structure and, in the event that such changes are not acceptable to UTS for the purposes of this Agreement, then UTS may terminate this Agreement by providing 7 days written notice to MU.
- 6.4. MU acknowledges that UTS has obligations under the ESOS Act and the Code and agrees to provide UTS with any information UTS considers reasonably necessary to assess and monitor MU's credentials to act as a partner institution of UTS, upon request by UTS. UTS may use or disclose that information to any person it reasonably considers necessary to allow it to properly check MU. UTS will not use that information for any other purpose.
- 7. COHORT SIZE**
- 7.1. A minimum cohort size of five (5) students per year enrolled onshore at UTS campus is to be adhered to by MU in order to sustain this articulation agreement. A review of the articulation



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agreement will be conducted in the event that a minimum student cohort cannot be achieved.

8. ACADEMIC MANAGEMENT

- 8.1. Eligible Students who undertake a undergraduate degree program will be:
- (a) subject to the UTS Rules, Directives and Policies; and
 - (b) liable to pay directly to UTS the student fees applicable to the UTS undergraduate degree programs as international students and as published on the UTS website.
- 8.2. UTS will confer the UTS Bachelor degree award on students who successfully complete the UTS undergraduate degree program in accordance with UTS Rules, Directives and Policies and established procedures.

9. NO WARRANTY

- 9.1. UTS makes no warranty or commitment that the undergraduate degree programs will continue to be available from time to time.
- 9.2. UTS will notify MU as soon as practicable if UTS intends to discontinue the undergraduate degree programs.
- 9.3. If UTS discontinues the undergraduate degree programs then this Agreement will terminate on the date specified in the notice provided under clause 9.2.

10. GOVERNMENT APPROVALS AND OTHER LAWS

- 10.1. Each party warrants that it will comply with all applicable laws and regulations including all Defence Trade Laws and Sanctions Laws.
- 10.2. Each party acknowledges their responsibility to ensure that the management, operation and delivery of the Articulation Program complies at all times with the applicable governmental and other regulatory requirements in their home jurisdiction.
- 10.3. MU acknowledges that UTS is required to meet certain obligations under the ESOS Act and Code and agrees to be bound by its provisions (as amended from time to time) insofar as they may apply to the Articulation Program. The ESOS Act and Code can be found: <https://www.aei.gov.au/regulatory-information/Education-Services-for-Overseas-Students-ESOS-Legislative-Framework/National-Code/Pages/default.aspx>
- 10.4. Each party shall advise the other of any changes in the rules, regulations and policies of their respective Government that may affect the delivery of the Articulation Program pursuant to this Agreement.



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11. INTELLECTUAL PROPERTY AND COPYRIGHT

- 11.1. Each party (and its employees) will retain all Intellectual Property Rights with respect to any and all promotional or marketing material created, developed or supplied by UTS for the delivery of the Articulation Program or otherwise ("Intellectual Property"). This will apply irrespective of whether the Intellectual Property was originally created in or translated into English or any other language.
- 11.2. For the Term of this Agreement, UTS grants MU a non-exclusive royalty free license of the copyright in all materials provided to MU by UTS for the purpose of promoting and marketing the Articulation Program and for no other purpose.
- 11.3. Procedures to secure and protect the Intellectual Property of UTS against loss, destruction and unauthorised access, use, copying, modification or disclosure.
- 11.4. UTS reserves the right to request that MU return (and/or destroy) all of its materials and/or Confidential Information when this Agreement expires or when this Agreement is terminated and MU agrees to return (and/or destroy) any such materials and Confidential Information.
- 11.5. MU must immediately notify UTS of any suspected or actual infringement of UTS's Intellectual Property Rights, or unauthorised use, copying or disclosure of Confidential Information. MU must provide any assistance reasonably requested by UTS in relation to any proceedings UTS may take for infringement of its Intellectual Property Rights, or the unauthorised use, copying or disclosure of its Confidential Information.

12. INDEMNITY

- 12.1. MU will release and indemnify UTS against any action, claim, suit or proceedings of any nature, in any jurisdiction arising or incurred directly or indirectly from:
 - (a) the breach by MU or its officers, employees or subcontractors of any provision of this Agreement; and/or
 - (b) the wilful or negligent acts or omissions of MU or its officers, employees or subcontractors or failure of MU or its officers, employees or subcontractors to comply with any law or contract, including (without limiting this clause) a failure to comply with any obligation to MU students.

13. INSURANCE

- 13.1. Both Parties will hold and maintain all relevant insurances required under the laws and regulations of their respective country.

14. CONFIDENTIALITY

- 14.1. The parties agree not to disclose or permit to be disclosed to any third party any Confidential Information in connection with this Agreement without the prior written consent of the affected party which consent may be conditional on the signing of a non-disclosure statement by the



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third party.

14.2. The MU acknowledges that UTS is an authority bound by privacy and health legislation including but not limited to the Privacy Act 1988 (Cth), the Privacy and Personal Information Protection Act 1998 (NSW) and all privacy policies, procedures instruments and directives which UTS may adopt or vary from time to time, in its absolute discretion (privacy legislation and policy). The MU agrees to comply with privacy legislation and policy to the extent that such privacy legislation and policy relates to any of its students or staff connected with this Agreement. As at the date of this Agreement the relevant policies, procedures instruments and directives are available at <http://www.gsu.uts.edu.au/policies/>.

14.3. This clause 14 will survive the expiration or termination of this Agreement.

15. TERMINATION AND VARIATIONS

15.1. Either party may terminate this Agreement at any date earlier than the expiration of the term of this Agreement by giving six (6) months' prior written notice to the other party.

15.2. Either party may terminate this Agreement by providing not less than thirty (30) days written notice to the other party, if the other party:

- (a) is in breach of this Agreement and, after notification of the breach by the non-defaulting party, fails to remedy that breach within five (5) Business Days; or
- (b) becomes an externally administered body corporate within the meaning of the Corporations Act 2001 (Cth) or the equivalent Thailand legislation; or
- (c) a party is declared bankrupt, enters into a scheme of arrangement with its creditors or commits a criminal offence.

15.3. If this Agreement is terminated pursuant to this clause 15, such termination will be without prejudice to any rights of the parties accrued prior to the date of termination.

15.4. The parties agree that notwithstanding the provisions of this clause 15 and clause 6.3, any Eligible Students who has submitted an Application to UTS to undertake a undergraduate degree program at the time notice of termination will receive the credit recognition provided under the Articulation Program. MU students enrolled in the undergraduate degree program will be permitted to complete their course if this Agreement is terminated for any reason.

15.5. This Agreement may be amended or varied only by written agreement of the parties.

16. NOTICE

16.1. Any consent, notice, approval or other communication ("Notices") that either party gives to the other party must be in writing and sent by airmail post, courier, email or facsimile transmission to the addresses given below.



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In the case of UTS:

Name: Liz Treacy
Position: Manager, International Pathway Programs
Address: PO Box 123 Broadway NSW 2007
Telephone: +61 2 9514 2767
Facsimile: +61 2 9514 2189
Email: elizabeth.treacy@uts.edu.au

In the case of MU:

Name: Assist. Prof. Dakrong Pissuwan
Position: Head of Multidisciplinary Unit
Address: Materials Science and Engineering Program, Multidisciplinary Unit, Faculty of
Science, Mahidol University. 272 Rama VI Road, Ratchathewi, Bangkok 10400, Thailand
Telephone: +66 2201 5935
Facsimile: +66 2201 5033
Email: dakrong.pis@mahidol.ac.th

16.2. Notices under this Agreement may be delivered by hand, by registered mail, by email or by facsimile to the addresses specified in clause 16.1 or any substitute address as may have been notified in writing by the relevant addressee from time to time.

16.3. Notice will be deemed to be given –

- (a) Five (5) Business Days after deposit in the mail with postage prepaid;
- (b) if hand delivered, on delivery; or
- (c) if sent by facsimile transmission, upon an apparently successful transmission being noted by the sender's facsimile machine prior to close of business at 5.00pm. Facsimile transmissions received after 5.00pm will be deemed to be received at the start of the next working day.
- (d) if sent by electronic mail, upon the apparent successful delivery of the message into the addressee's machine prior to close of business at 5.00pm. Electronic messages received after 5.00pm will be deemed to be received at the start of the next working day.

17. FINANCE, COST AND ADMINISTRATION

17.1. Each party must bear its own costs of negotiating, preparing and executing this Agreement.

17.2. MU students are responsible for all living, travel, visa, health, personal expenses, excess luggage and other costs incurred in order to study as an international student in Sydney, Australia.

17.3. Each party will nominate a person to undertake the role of Course Coordinator (the Course Coordinator). The Course Coordinator shall be responsible for providing academic advice and administration of the Articulation Program relevant to that party's degree component.



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- 17.4. Each party will nominate a person to undertake the role of administrative officer (the Administrative Officer is listed in 16.1), to support the daily general and student administration of the Articulation Program, relevant to that party's course component.
- 17.5. The parties agree that with respect to e-mail communication between both parties and between the parties and the students undertaking the Articulation Program that:
- (a) any e-mail correspondence will be responded to within three (3) days (excluding weekends); and
 - (b) all e-mail correspondence between the parties and students will be transmitted in English.
- 17.6. The parties may agree to implement further administrative procedures to assist in the administration of the Articulation Program.

18. COHORT COMMENCEMENT

- 18.1. This Agreement will apply to MU students enrolling in a UTS undergraduate degree program from the commencement of the UTS semester 2 (July) academic teaching period in 2017 until the expiry of the term (subject to clause 15 (Termination and Variations)).

19. DISPUTE RESOLUTION

- 19.1. All disputes arising from the execution of, or in connection with this Agreement shall be settled through friendly consultation between the parties. If the parties have a problem or dispute in relation to any of the terms or effect of this Agreement, the parties will first seek to resolve the problem or dispute by direct negotiation using their best endeavours to settle the problem or dispute. If the problem or dispute continues for a period of 30 days after the parties have negotiated in good faith to resolve the problem or dispute, the parties may elect a third party by mutual consent, who will examine the problem or dispute and provide recommendations. All expenses incurred in appointing the elected third party will be shared equally by the parties.

20. GENERAL

- 20.1. This Agreement will be governed by and construed according to the law of New South Wales and the parties agree to submit to the jurisdiction of the Courts of New South Wales.
- 20.2. The parties shall not use the other party's name or logo in any publication or for any other purpose whatsoever without the prior written consent of the other party and then only in the manner and format specified by the other party.
- 20.3. Neither party shall assign, subcontract or otherwise transfer its rights and obligations under this Agreement without the prior written consent of the other party.
- 20.4. A complete or partial failure or omission by a party to require the strict or timely compliance with any provision in this Agreement shall in no way affect or prejudice that party's rights to avail itself of all of its rights and remedies under the applicable law for a breach of that provision.



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- 20.5. If any part of this Agreement is or later becomes unenforceable, then:
- (a) those unenforceable terms shall be deleted from this Agreement, to the extent that they are unenforceable; and
 - (b) the remaining terms of this Agreement shall continue in full force and effect.
- 20.6. This Agreement contains the whole understanding of the parties relating to its subject matter and it supersedes and cancels any and all representations, agreements and commitments made by the same parties with respect to the same subject matter. Any purported representations warranties or other promises of the parties not recorded in this Agreement are of no effect.



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EXECUTED AS AN AGREEMENT

Signed for and on behalf of
MAHIDOL UNIVERSITY
by its authorized officer

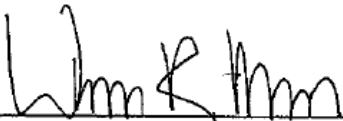
Signed for and on behalf of
UNIVERSITY OF TECHNOLOGY SYDNEY
by its authorized officer

THAILAND

SYDNEY, AUSTRALIA



Professor Sansanee Chaiyasri



Professor William Purcell

Vice President for Research and
International Relations

Deputy Vice-Chancellor (International and
Advancement)

Date: 20/01/2017

Date: 12/01/2017



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APPENDIX 1: APPROVED CREDIT RECOGNITION BETWEEN MU AND UTS

CREDIT RECOGNITION DEFINITION	External subjects recognised for CR	UTS subjects/study packages to be exempted	Total amount of CR	Remaining course duration
	<p>Bachelor of Materials Science & Nano Engineering – International Program</p> <p>SCCH161: General Chemistry, SCCH189: Chemistry Laboratory, SCID201: Learning Techniques, SCID103: Technology in Daily Life, SCID305: General Skill in Science Research, SCME372: Scientific Creativity and Innovation, SCPY178: General Physics, SCPY160: General Physics Laboratory, SCBI163: Essential Biology, SCBI192: Biology Laboratory, SCID102: Cell & Molecular Biology, SCME101: Introduction to Materials, PRPR101: Population and Development, LAEN380: Academic Presentation in English, LAEN180: English for Academic Purpose I, ENGE105: Integrated Health and Environment, LAEN181: English for Academic Purpose II, PRPR102: Regional Studies, EGIE195: Basic Engineering Workshop, and EITHER LAEN280: Science Fiction and Society OR LAEN281: The Science of Speech Sounds</p>	<p>C10242 Bachelor of Science (Nanotechnology)</p> <p>65111 Chemistry 1 60001 Principles of Scientific Practice 68037 Physical Modelling 91161 Cell Biology and Genetics 68070 Introduction to Materials 18 cp of Unspecified Electives</p>	48cp	4 semesters
ADMISSION REQUIREMENTS IN UTS COURSE/S	<p>Academic admission requirements</p> <p>Successful completion of year 1 of MU course with a GPA greater than 2.5/4</p>	<p>English language requirements</p> <p>IELTS (Academic) 6.5 overall with a writing score of 6.0, or TOEFL internet based 79-93 overall with a writing score of 21, or AE5 Pass, or PTE (Academic) 58-64, or CAE 176-184</p>	<p>Evidence of English language proficiency</p> <p>Yes</p>	<p>Currency of prior learning</p> <p>1 year</p>