Core course   Undergraduate Program
Course Title Calculus II   Mahidol University International College
Course Code: ICMA 213   Division: Science

TQF 3 Course Specifications
Section 1 General Information

1. Course code and course

title   Thai   <u>ICMA 213   แคลคูลัส ๒</u>

        English   <u>ICMA 213   Calculus II</u>

2. Number of credits   4(4-0-8) (Lecture/Lab/Self-study)

3. Program and type of subject

       3.1 Program   <u>Undergraduate Degree (International Program)</u>

       3.2 Type of Subject   <u>Applied Mathematics Core Course</u>

4. Course Coordinator and Course Lecturer

       4.1   Course Coordinator   Asst. Prof. Dr. Pornrat Ruengrot

       4.2   Course Lecturer   Asst. Prof. Dr. Thotsaporn Thanatipanonda

5. Trimester/ Year of Study

       5.1 Trimester   All trimesters / for all students in every Science Undergraduate Program

       5.2 Course Capacity   Approximately 30 students

6. Pre-requisite   -

7. Co-requisites   -

8. Venue of Study   Mahidol University, Salaya campus

9. Date of Latest Revision

       Date 20 Month August Year 2020

Section 2 Goals and Objectives

1. Course Goals

To provide students with foundational concepts of calculus which include integration techniques, improper integrals and infinite series.

2. Objectives of Course Development/Revision

2.1 Course Objectives

The fundamental concepts of calculus are derivatives and integrals. Knowledge and ability to work with these concepts is essential for further studies of mathematical subjects, as well as for applications of mathematical techniques in other sciences. This course will focus on understanding calculus concepts, analytical reasoning and developing crucial skills in order to calculate, analyze, interpret and communicate the results clearly.

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2.2 Course-level Learning Outcomes: CLOs

By the end of the course, students will be able to (CLOs)

1. CLO1 Communicate mathematics and explain solutions to problems both verbally and in written sentences.
2. CLO2 Model a written description of a physical situation with a function, a differential equation or an integral.
3. CLO3 Understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of change and should be able to use integrals to solve a variety of problems.
4. CLO4 understand the series as functions and be able to perform some convergence test with series as a number and as a function.

Section 3 Course Management

1. Course Description

ฟังก์ชัน ลิมิต ความต่อเนื่อง อนุพันธ์ เทคนิคการหาอนุพันธ์และการประยุกต์ ส่วนกลับของอนุพันธ์ dและการหาพื้นที่

Functions, derivatives, techniques of integrations and application, series, Taylor series, convergence/divergence.

2. Credit hours per trimester

Lecture (Hour(s))	Laboratory/field trip/internship (Hour(s))	Self-study (Hour(s))
48 (4 hours x 12 weeks)	-	96 hours (8 hours x 12 weeks)

3. Number of hours that the lecturer provides individual counseling and guidance.

1 hours/week

Section 4 Development of Students' Learning Outcome

1. Short summary on the knowledge or skills that the course intends to develop in students (CLOs)

By the end of the course, students will be able to

1. CLO1 Communicate mathematics and explain solutions to problems both verbally and in written sentences.
2. CLO2 Model a written description of a physical situation with a function, a differential equation or an integral.

3. CLO3 Understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of change and should be able to use integrals to solve a variety of problems.
4. CLO4 understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.

2. Teaching methods for developing the knowledge or skills specified in item 1 and evaluation methods of the course learning outcomes

Course Code	Teaching methods	Evaluation Methods
CLO1	Reading assignment, problem assignment, group discussion, Interactive lecture	Quiz, Midterm and Final
CLO2	Reading assignment, problem assignment, group discussion, Interactive lecture	Quiz, Midterm and Final
CLO3	Reading assignment, problem assignment, group discussion, Interactive lecture	Quiz, Midterm and Final
CLO4	Reading assignment, problem assignment, group discussion, Interactive lecture	Quiz, Midterm and Final

Section 5 Teaching and Evaluation Plans

1. Teaching plan

Class	Topic/Details	In-Class sessions	Lab sessions	Online Sessions	On-Campus	Instructors	Note
1	Logarithmic and exponential functions	2		x		TT	
2	Logarithmic and exponential functions	2		X		TT	
3	Logarithmic and exponential functions	2		X		TT	
4	Logarithmic and exponential functions	2		X		TT	
5	Techniques of integration	2		X		TT	

Class	Topic/Details	Number of hours		Online Sessions	On-Campus	Instructors	Note
		In-Class sessions	Lab sessions				
6	Techniques of integration	2		X		TT	
7	Techniques of integration	2		X		TT	
8	Techniques of integration	2		X		TT	
9	Techniques of integration	2		X		TT	
10	Techniques of integration	2		X		TT	
	Test 1						
11	Improper integrals and indeterminate forms	2		X		TT	
12	Improper integrals and indeterminate forms	2		X		TT	
13	Improper integrals and indeterminate forms	2		X		TT	
14	Improper integrals and indeterminate forms	2		X		TT	
15	Partial Derivatives	2		X		TT	
16	Partial Derivatives	2		X		TT	
17	Partial Derivatives	2		X		TT	
18	Partial Derivatives	2		X		TT	

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Class	Topic/Details	Number of hours		Online Sessions	On-Campus	Instructors	Note
		In-Class sessions	Lab sessions				
	Test 2						
19	Infinite Series	2		X		TT	
20	Infinite Series	2		X		TT	
21	Infinite Series	2		X		TT	
22	Infinite Series	2		X		TT	
23	Infinite Series	2		X		TT	
24	Infinite Series	2		X		TT	
	Final Exam				X	TT	
	Total	48	0	48	4		

* TT = Thotsaporn Thanatipanonda

2. Plan for Assessing Course Learning Outcomes

    2.1 Assessing and Evaluating Learning Achievement

        a. Formative Assessment

- Individual quiz results
- Midterm results
- Class discussion
- Reflective questions
- Answer comparison

b. Summative Assessment

    (1) Tools and Percentage Weight in Assessment and Evaluation

Learning Outcomes	Assessment Methods	Assessment Ratio (Percentage)	
CLO1 Communicate mathematics and explain solutions to problems both verbally and in written sentences.	Midterm	15	20
	Quiz	5	
	Midterm	10	40

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CLO2 Model a written description of a physical situation with a function, a differential equation or an integral.	Final	25	
	Quiz	5	
CLO3 Understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of change and should be able to use integrals to solve a variety of problems.	Midterm	10	20
	Final	5	
	Quiz	5	
CLO4 Understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.	Midterm	15	20
	Quiz	0	
	Final	5	
			100

(2) Grading System

Grade	Achievement	Final Score (% Range)	GPA
A	Excellent	90-100	4.0
B+	Very good	85-89	3.5
B	Good	80-84	3.0
C+	Fairly good	75-79	2.5
C	Fair	70-74	2.0
D+	Poor	65-69	1.5
D	Very Poor	60-64	1.0
F	Fail	Less than 60	0.0

(3) Re-examination (If course lecturer allows to have re-examination)
        N/A - (Not applicable with MUIC)
3. Student Appeals
        In writing to the Associate Dean of Academic Affairs and Research

Section 6 Teaching Materials and Resources

1. Textbooks and/or other documents/materials
    1. H. Anton, Calculus: Late Transcendentals, 10th edition, John Wiley \& Sons, New York. 2. Recommended textbooks and/or other documents/materials
    2. D. Guichard, Calculus: Early Transcendentals.
2. Other Resources (If any)
    Handouts

Section 7 Evaluation and Improvement of Course Management

1. Strategies for evaluating course effectiveness by students
    1.1 Student feedback of instructors, teaching methods and materials, and course content through MUIC student evaluation forms
2. Strategies for evaluating teaching methods
    2.1 Evaluation of effectiveness based on student evaluation scores and comments

    2.2 Evaluation through peer observations by co-instructor or other Division faculty

3. Improvement of teaching methods
    3.1 Adjustments based on student feedback, personal observations, comments from peer observations and discussions with supervisor and/or other Division faculty in one-on-one and/or group meetings as specified by MUIC guidelines

4. Verification process for evaluating students' standard achievement outcomes in the course
    4.1 Verification through student performance on assessments based on MUIC/Division standards

5. Review and plan for improving the effectiveness of the course

    5.1 Course instructors (and coordinator/supervisor) will meet to discuss results of student evaluations and student performance based on learning outcomes in order to identify point for improvement

    5.2 Strategy for improvement set according to MUIC/Division guidelines

Appendix
Alignment between Courses and Major courses
Table 1 The relationship between course and Program Learning Outcomes (PLOs)

Calculus I	Program Learning Outcomes (PLOs)						
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
ICMA106	I	I		I		I	

Note: Indicate the level of CLOs by letter I, R, P or M. Using the information as shown in

the Curriculum Mapping of TQF2

Table 2 The relationship between CLOs and Program LOs (Number in table = Sub LOs)

ICMA106	Learning Outcomes in Applied Mathematics Program						
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7
CLO1 Communicate mathematics and explain solutions to problems both verbally and in written sentences.	1.1	2.1					
CLO2 Model a written description of a physical situation with a function, a differential equation or an integral.	1.3	2.2		4.1		6.3	
CLO3 Understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of change and should	1.2 1.3						

be able to use integrals to solve a variety of problems.						
CLO4 Understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.	1.2	2.2			6.1	

Table 3   The description of Program LOs and Sub LOs of the course

Program LOs	Sub LOs
Acquire the basic skills and conceptual understanding regarding differential, integral and multivariable calculus, as well as that of fundamental mathematical objects introduced in our core courses such as sets, functions, equations, vectors, matrices, and groups	1.1 Recognize and describe what mathematical knowledge is required for a given set of problems 1.2 Use appropriate technical skills to solve problems 1.3 Synthesize information to arrive at logical reasoning in the context of mathematics
Use knowledge of content and mathematical procedures to solve problems and make connections between the different areas of mathematics	2.1 Apply concepts of mathematics to solving application problems 2.2 Connect, synthesize and/or transform ideas or solutions within a particular framework
Demonstrate intellectual curiosity and a strong propensity towards independent learning	3.1 Demonstrate the analytical, communication, problem solving, interpersonal, and technical skills that will 3.2 Draw meaningful conclusion from the learning materials

	3.3 Assess the relevance of the information
Demonstrate mathematical thinking skills, progressing from a procedural and computational understanding of mathematics to logical reasoning, pattern recognition, generalization, and abstraction, and to a formal proof	4.1 Demonstrate ability to think like a mathematician in the following aspects: critical thinking, problem solving, and quality of the thinking 4.2 Integrate alternative, divergent, or contradictory perspectives or ideas in the solution of a problem or question 4.3 Create an original explanation or solutions to the situations/problems
Apply concepts of scientific integrity and commit to professional ethics and responsibilities and norms of the profession	5.1 Demonstrate moral and appropriate behavior 5.2 Recognize ethical issues related to mathematics 5.3 Identify national & global current issues and their relations to mathematics 5.4 Apply accepted ethical standards to resolve issues 5.5 Collaborate effectively with others as a responsible team member 5.6 Demonstrate abilities to maintain an unbiased review and approaching the process for its value, expanding
Communicate mathematical ideas orally and in writing, with precision, clarity and organization, using proper terminology and notation	6.1 Communicate/present ideas effectively both oral & written forms, proper to audience groups 6.2 Prepare a purposeful oral presentation 6.3 Prepare written documents to communicate information/ideas
Acquire proficiency in the use of technology and numerical techniques to assist in learning and investigating mathematical ideas and in problem-solving	7.1 Describe process of transposing of data into computer-based information 7.2 Describe process of transposing of problems into computer-based information 7.3 Manage scientific projects using mathematical softwares