Program: Engineering & Environmental Science

Course Title   Mathematics II

Course Code   SCMA 102

Degree ☑ Bachelor ☐ Master ☐ Doctoral

Faculty of Science

Department of Mathematics

TQF 3   Course Specification

Section 1 General Information

1. **Course code and title**

   Thai   วทคณ ๑๐๒ คณิตศาสตร์ ๒

   English   SCMA 102 Mathematics II

2. **Number of credits**   4 (4–0–8) credits

   Lecture 4 – Laboratory 0 – Self-study 8 hours/week

3. **Program and category of the course**

   3.1 Program   Bachelor's Degree Program in Science and Technology

   (International Program)

   EGCG, EGII, ENNM

   3.2 Category of the course   Specific Courses

4. **Course responsible faculty member and instructors**

   4.1 Course responsible faculty member

   Asst. Dr. Kornkanok Bunwong

   Department of Mathematics, Faculty of Science

   Tel. 02-201-5340   e-mail: kornkanok.bun@mahidol.ac.th

   4.2 Instructors:

   Dr. Watthanan Jatuviriyapornchai (WJ)

   E-mail: watthanan.jat@mahidol.ac.th

5. **Semester / Level of study**

   5.1 Semester   2nd Semester / First year

   5.2 Number of student   30-25 students

6. **Pre-requisite**   SCMA 101 Mathematics I

7. **Co-requisites**   None

8. **Venue of study**   Faculty of Science, Mahidol University, Salaya campus/Online via WebEx

9. **Date of preparation/latest revision**   December 2021

Section 2 Goals and Objectives

1. **Course goals**

   This course intends to develop students' knowledge to explain and apply fundamental knowledge of infinite sequences and series, calculus on functions of several variables, differential equations, and linear algebra appropriate to real-world problem.

2. **Objectives of development/revision**

   2.1 Course objectives

   Students should be able to explain definition and apply fundamental knowledge of infinite sequences and series, calculus on functions of several variables, differential equations, and linear algebra appropriate to real-world problem.

   2.2 Course-level learning outcomes: CLOs

   After successful completion of this course, students should be able to:

   1) Explain definition and fundamental knowledge of infinite sequences and series, calculus on functions of several variables, differential equations, and linear algebra. (CLO1)

   2) Examine the convergence of infinite sequences and series. (CLO2)

   3) Solve ordinary differential equations and system of linear equations. (CLO3)

   4) Apply differential equations and linear algebra to the real-world problems. (CLO4)

Section 3 Description and Implementation

1. Course description

    ลำดับอนันต์และอนุกรมอนันต์ ฟังก์ชันของหลายตัวแปร ลิมิตและความต่อเนื่องของฟังก์ชันหลายตัวแปร อนุพันธ์ย่อย สมการเชิง
อนุพันธ์เชิงเส้นอันดับหนึ่ง สมการเชิงอนุพันธ์ไม่เชิงเส้นอันดับหนึ่ง สมการเชิงอนุพันธ์เชิงเส้นอันดับสูง การประยุกต์สมการเชิงอนุพันธ์
ระบบสมการเชิงเส้น พีชคณิตเชิงเส้น การประยุกต์พีชคณิตเชิงเส้น

    Infinite sequences and series; functions of several variables; limits and continuity of functions of several varia-
bles; partial derivatives; first order linear differential equations; first order nonlinear differential equations; higher
order linear equations; applications of differential equations; systems of linear equations; linear algebra; applications
of linear algebra.

2. Credit hours/Semester

Lecture (hours)	Laboratory/Field trip/Internship (hours)	Self-study (hours)
4	0	8

3. Number of hours that the instructors provide individual counseling and guidance

    Instructors provide academic counseling and guidance to individual at least 1 hour/week or upon request dur-
ing office hours (Monday-Friday).

Section 4 Development of Students' Learning Outcomes

1. Short conclusion on knowledge or skills that the course intends to develop students

After successful completion of this course, students should be able to:

CLO1: Explain definitions and fundamental knowledge of infinite sequences and series, calculus on functions of several variables, differential equations, and linear algebra.

CLO2: Examine the convergence of infinite sequences and series.

CLO3: Solve ordinary differential equations and system of linear equations.

CLO4: Apply each concept to the real-world problems.

2. Method to evaluate students' learning outcome in this course and to evaluate the learning outcomes specified in the standard

The alignment of learning outcomes, teaching strategies and evaluation strategies is shown below.

SCMA 102 Mathematics II	Teaching strategies	Evaluation strategies
CLO1	Interactive lecture, effective questioning	- Individual work - Exams
CLO2	Interactive lecture, effective questioning problem solving	- Individual work - Exams
CLO3	Interactive lecture, effective questioning problem solving	- Individual work - Exams
CLO4	Interactive lecture, effective questioning problem based activities	- Individual work - Exams

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Section 5 Teaching and Evaluation Plans

1. Teaching plan

Week	Topics	Number of hours (In-class activity – Lab)	Teaching method/ Media	Instructors
1	Infinite sequences	4 – 0	Interactive lecture, effective questioning, problem solving, problem based activities / lecture notes, slides, individual assignments, quizzes	WJ
2	Infinite series	4 – 0		
3	Functions of several variables	4 – 0		
4	Introduction to Differential equations	4 – 0		
5	Techniques of solving first order ODEs - separable equations	4 – 0		
6	Techniques of solving first order ODEs - exact equations /integrating factor	4 – 0		
7	Techniques of solving first order ODEs - linear equations - Bernoulli's equations	4 – 0		
8	Midterm examination			
9	Higher order linear homogeneous ODEs - fundamental concepts - constant coefficient ODEs	4 – 0	Interactive lecture, effective questioning, problem solving, problem based activities / lecture notes, slides, individual assignments, quizzes	WJ
10	Higher order linear nonhomogeneous ODEs - Method of Undetermined Coefficients - Method of Variation of Parameters	4 – 0		
11	Applications of ODEs	4 – 0		
12	Systems of linear equations - Cramer's rule - Row operation	4 – 0		

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Week	Topics	Number of hours (In-class activity – Lab)	Teaching method/ Media	Instructors
13	Vector space	4 – 0		
14	Linear transformation	4 – 0		
15	Eigenvalues and eigenvectors	4 – 0		
16	Applications of linear algebra	4 – 0		
17	Final Examination			

2. Evaluation plan

2.1 Learning measurement and evaluation

A. Formative assessment

Quiz and class observation.

B. Summative assessment

(1) Evaluation methods and weight

Course Learning Outcomes	Evaluation		%Weight
	Individual work	Exams	
CLO1: Explain definition and fundamental knowledge of infinite sequences and series, calculus on functions of several variables, differential equations, and linear algebra.	10%	10%	20%
CLO2: Examine the convergence of infinite sequences and series.	5%	5%	10%
CLO3: Solve ordinary differential equations and system of linear equations.	25%	25%	50%
CLO4: Apply each concept to the real-world problems.	10%	10%	20%
Total	50%	50%	100%

(2) Grading system

Students are evaluated their performance using assessment rubric according to course objectives and learning outcomes. Rubric scores for a single piece of individual work

Score	Description
10	Demonstrates the required work for all questions.
8	Demonstrates the required work for most questions with lower than 25% mistakes.
6	Demonstrates the required work for many questions with lower than 50% mistakes.
4	Demonstrates the required work for some questions with more than 50% mistakes.
2	Demonstrates the required work for few questions with more than 75% mistakes.
0	No response

The percentage of individual work is the average rubric scores of all pieces of individual work.

After completion of the evaluation process each student is assigned a criterion-referenced grade (as shown in the table below). Evaluation and achievement will be justify according to Faculty and University code, conducted by grading system of A, B+, B, C+, C, D+, D and F. To pass this course, student must earn a grade of at least D.

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

3. Academic Appeal

Students may 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 Teaching Materials and Resources

1. Textbooks and required documents

Course lecture note

2. Suggested Materials

1) Boyce WE. Elementary differential equations and boundary valued problems. 11th ed. New York: Wiley; 2018.

2) Strang G. Differential equations and linear algebra. Wellesley-Cambridge Press; 2015.

3) Ross SL. Introduction to ordinary differential equations. 4th ed. New York: Wiley; 1991.

4) James Stewart, Calculus: Early Transcendentals. 8th ed., Brooks Cole; 2015

5) Anton H, Bivens I, Davis S. Calculus. 10th ed., New York: Wiley; 2012.

3. Electronic information and websites (if any)

1) Available through MU Library-subscribed databases

2) https://www.khanacademy.org

3) https://www.edx.org

4) https://www.coursera.org

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Section 7 Evaluation and Improvement of Course Management

1. Strategies for effective course evaluation by students

Evaluation of instructor and course through Mahidol University E-Evaluation System

2. Evaluation strategies in teaching methods

Evaluated by course evaluation by student (Mahidol University E-Evaluation System) and student performance (Section 5)

3. Improvement of teaching methods

Course responsible faculty member and instructors revise and improve strategies by reviewing of the output of the student evaluation. Review of turning-in individual work assignment quality as planned (Section 5) is used to adjust teaching method to enhance student's learning achievement.

4. Evaluation of students' learning outcomes

Analysis of students' learning outcomes using student's total percentage of evaluation taken from review of class attendance record, review of on-time assignment submission review of individual response according to examination rules and regulations, review of turning-in individual work assignment quality, and written examination by the course responsible faculty member and instructors. The evaluation results are peer-reviewed the international committee for undergraduate study of the Industrial Engineering Department.

5. Review and improvement plan for course effectiveness

Course responsible faculty member and instructors review course effectiveness in achieving course learning outcomes using outputs from course and instructor evaluation (Mahidol University E-Evaluation System), student evaluation (Section 5), and formal complaint or academic appeal (if any) to determine further improvement plan.