MU3

Revised: Jul. 2023

Program B.Sc. In Science and Technology Program Level ☑ Bachelor ☐ Graduate Diploma ☐ Master ☐ Higher Graduate Diploma ☐ Doctor
Course Title Mathematics II Faculty of Science
Course Code SCMA 102 Department of Mathematics

Course Specification

Section 1 General Information

1. Course Code and Title

In Thai วทคณ ๑๐๒ คณิตศาสตร์ ๒

In English SCMA 102 Mathematics II

2. Number of Credits

4 (4–0–8) credits

(Theory 4 hrs. Practice 0 hrs. Self-Study 8 hrs./week)

3. Curriculum and Course Type

3.1 Program Bachelor's Degree Program in Science and Technology
(International Program) EGBI, EGCG, EGII, ENNM

3.2 Course Type Specific Course ☑ Compulsory Course ☐ Elective Course

4. Course Coordinator and Instructor

4.1 Course Responsible Instructor Assoc. Prof. Nattapong Bosuwan

4.2 Instructors Assoc. Prof. Nattapong Bosuwan
Department of Mathematics, Faculty of Science
E-mail address: nattapong.bos@mahidol.ac.th

5. Semester/Class Level

5.1 Semester First Semester / Class Level First Year

5.2 Number of Students Allowed Approximately 100 Students

6. Prerequisites

None

7. Co-requisites

None

8. Date of Preparation/Latest Revision of the Course Specifications

Day 16 Month December Year 2025

Section 2 Course Goals and Course Description

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. Course Description

(In Thai) ลำดับอนันต์และอนุกรมอนันต์ ฟังก์ชันของหลายตัวแปร ลิมิตและความต่อเนื่องของฟังก์ชันหลายตัวแปร อนุพันธ์ย่อย สมการเชิงอนุพันธ์เชิงเส้นอันดับหนึ่ง สมการเชิงอนุพันธ์ไม่เชิงเส้นอันดับหนึ่ง สมการเชิงอนุพันธ์เชิงเส้นอันดับสูง การประยุกต์สมการเชิงอนุพันธ์ ระบบสมการเชิงเส้น พีชคณิตเชิงเส้น การประยุกต์พีชคณิตเชิงเส้น

(In English) Infinite sequences and series; functions of several variables; limits and continuity of functions of several variables; 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.

Section 3 Course Objectives, Course-level Learning Outcomes and Course Implementation

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. Course-level Learning Outcomes: CLOs

On completion of the course, the students will be able to

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

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

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

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

3. How to organize learning experiences to develop the knowledge or skills stated in number 2 and how to measure the learning outcomes

CLOs	Teaching and learning experience management	Learning outcomes measurements
CLO1	Interactive lecture, effective questioning, formative assessment	Individual assignments, written exam, group project
CLO2	Interactive lecture, effective questioning, formative assessment	Individual assignments, written exam, group project
CLO3	Interactive lecture, effective questioning, formative assessment	Individual assignments, written exam, group project
CLO4	Interactive lecture, effective questioning, formative assessment	Individual assignments, written exam, group project

Section 4 Lesson Plan and Evaluation

1. Lesson Plan

Teaching Period	Topics/Details	Number of hours		Methods: Teaching Media	Lecturer
		Theory*	Practice**		
1	Infinite sequences	4:00	0	Lecture: Lecture Note	NB
2	Infinite series	4:00	0	Lecture: Lecture Note	NB
3	Functions of several variables - limit / continuity / partial derivatives - total differentials / total derivatives	4:00	0	Lecture: Lecture Note	NB
4	Differential equations - classification - initial value problems Techniques of solving first order ODEs - separable equations	4:00	0	Lecture: Lecture Note	NB
5	Techniques of solving first order ODEs - exact equations / integrating factor	4:00	0	Lecture: Lecture Note	NB
6	Techniques of solving first order ODEs - linear equations - Bernoulli's equations	4:00	0	Lecture: Lecture Note	NB
7	Techniques of solving first order ODEs - Homogeneous equations	4:00	0	Lecture: Lecture Note	NB

Teach-ing Period	Topics/Details	Number of hours		Methods: Teaching Media	Lecturer
		Theory*	Practice**		
8	Midterm examination				
9	Higher order linear homo-geneous ODEs - fundamental concepts - constant-coefficient ODEs	4:00	0	Lecture: Lecture Note	NB
10	Higher order linear nonhomoge-neous ODEs - Method of Undetermined Coef-ficients - Method of Variation of Parame-ters	4:00	0	Lecture: Lecture Note	NB
11	Applications of ODEs	4:00	0	Lecture: Lecture Note	NB
12	Systems of linear equations - Cramer's rule - row operation - existence and uniqueness theorem	4:00	0	Lecture: Lecture Note	NB
13	Vector space	4:00	0	Lecture: Lecture Note	NB
14	Linear transformation	4:00	0	Lecture: Lecture Note	NB
15	Eigenvalues and eigenvectors	4:00	0	Lecture: Lecture Note	NB
16	Group Project	4:00	0	Group project presentation: ppt	NB
17	Final Examination				
	Total hours of the entire semester	**60:00**	**0:00**		

2. Plan for Assessment of Expected Course-Level Learning Outcomes (CLOs)

2.1 Measurement and Evaluation of learning achievement

A. Formative Assessment

During a lesson, the instructor keeps the questions going and generally monitors students' progress. There are also quick quizzes to check each student's current understanding.

B. Summative Assessment

(1) Tool and weight for measurement and evaluation

Learning Outcomes	Evaluation Method*				Weight (Percentage)
	Group Work	Individual work	Quizzes	Exams	
CLO1 Examine the convergence of infinite sequences and series.	2.5%	5%	2.5%	15%	**25%**
CLO2 Examine the convergence of infinite sequences and series.	2.5%	5%	2.5%	15%	**25%**
CLO3 Solve ordinary differential equations and system of linear equations.	2.5%	5%	2.5%	15%	**25%**
CLO4 Apply each concept to the real-world problems.	2.5%	5%	2.5%	15%	**25%**
รวม	**10%**	**20%**	**10%**	**60%**	**100%**

(2) Grading Rules

After completion of the evaluation process each student is assigned a criterion-referenced grade (as shown on the table below). Evaluation and achievement will be justified according to Facul-ty and University code, conducted by grading system of A, B+, B, C+, C, D+, D and F.

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) Measurement and Evaluation

To pass this course, students must earn a grade of at least D.

2.2 Re-examination (if the course allows any.)

None

3. Students' 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.

Section 5 Teaching Resources

1. Required Texts

1) Boyce WE. Elementary differential equations and boundary valued problems. 8th ed. New York: Wiley; 2006.
2) Ross SL. Introduction to ordinary differential equations. 4th ed. New York: Wiley; 1989.

2. Suggested Materials

1) James Stewart, Calculus: Early Transcendentals. 6th ed., Brooks Cole; 2007.
2) Anton H, Bivens I, Davis S. Calculus. 7th ed. New York: Wiley; 2002.

3. Other Resources (if any)

1) https://www.wolframalpha.com

2) https://www.khanacademy.org

3) https://www.edx.org

4) https://www.coursera.org

5) https://www.desmos.com/calculator

Section 6 Evaluation and Improvement of Course Implementation

1. Analysis and Evaluation of Course Implementation

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

2. Revision Process and Improvement Plan for Course Effectiveness

Course responsible faculty member and instructors revise and improve strategies by reviewing 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.

3. The self-assessment report of the course

Lecturers and Course responsible faculty members 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

Appendix

1. Relations between the course and the program

Table 1 Relations between the course and the PLOs

Course Title Mathematics II	Program-Level Learning Outcomes (PLOs)							
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO..	PLO..
(Course Code) SCMA 102								

แสดงระดับการจัดกำเรียนรู้ของรายวิชา ด้วยอักษร I, R, P หรือ M โดยนำข้อมูลของรายวิชาที่แสดงไว้ในหลักสูตร Curriculum Mapping มาแสดงให้สอดคล้องกัน

Table 2 Relation between CLOs and PLOs

(Course Code) SCMA 102	Program-Level Learning Outcomes (PLOs)							
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO..	PLO..
CLO1 Examine the convergence of infinite sequences and series.								
CLO2 Examine the convergence of infinite sequences and series.								
CLO3 Solve ordinary differential equations and system of linear equations.								
CLO4 Apply differential equations and linear algebra to the real-world problems.								

ระบุว่าแต่ละ CLO สอดคล้องกับ PLO ในระดับ SubPLO ใดบ้าง โดยใส่หมายเลขของ SubPLO ใน column PLO ที่ตรงกัน เพื่อ แสดงความเชื่อมโยงให้ชัดเจน (Program-level Constructive Alignment)

2. Rubric scoring*

***หมายเหตุ** ถ้ามีการใช้ Rubric scoring เป็นเครื่องมือในการวัดผล ให้แสดงเพิ่มเติมในภาคผนวกข้อที่ ๒.

3. Relations between the course and Sustainable Development Goals (SDGs)

- ☐ SDG1 No poverty
- ☐ SDG2 Zero Hunger
- ☐ SDG3 Good Health and Well – being
- ☑ SDG4 Quality Education
- ☐ SDG5 Gender Equality
- ☐ SDG6 Clean Water and Sanitation
- ☐ SDG7 Affordable and Clean Energy
- ☐ SDG8 Decent Work and Economic Growth
- ☐ SDG9 Industry, Innovation and Infrastructure
- ☐ SDG10 Reduced Inequalities
- ☐ SGD11 Sustainable Cities and Communities
- ☐ SDG12 Responsible Consumption and Production
- ☐ SDG13 Climate Action
- ☐ SDG14 Life Below Water
- ☐ SDG15 Life on Land
- ☐ SDG16 Peace, Justice and Strong Institutions
- ☐ SDG17 Partnerships for the goals