TQF. 3

☑ Bachelor's Degree

☐ Master's Degree

Course Specification

Course Code: BMA 2303

Course Title: Mathematical Problem Solving

Credits: 3(3-0-6)

Programs: Bachelor of Education Program in Mathematics Education
(Bilingual Program)

Semester: 2 **Academic Year:** 2021

College of Hospitality Industry Management
Suan Sunandha Rajabhat University
(CHM, SSRU)

Section 1 General Information

1. Code and Course Title: BMA 2303 Mathematical Problem Solving

2. ชื่อวิชา (ภาษาไทย): BMA 2303: การแก้ปัญหาทางคณิตศาสตร์

3. Credits: 3(3-0-6)

3. Curriculum and Course Category :

Curriculums: Bachelor's of Education, Mathematics (Bilingual Program)

Course Category:

☐ General Education ☑ Required Course

☐ Elective Course ☐ Others: …….

4. Lecturers: Asst.Prof. Dr. Krongthong Khairiree

5. Year / Semester

Students Year 1 / Semester 2/2564

6. Prerequisite Course

None

7. Co-requisite Course :

None

8. Learning Location

College of Hospitality Management, Suan Sunandha Rajabhat University,
Nakorn Patom Education Center

9. Last Date for Preparing and Revising this Course:

December, 2021

Section 2 - Aims and Objectives

2.1 Course Objectives

At the end of this course, the students will be able to perform in the following areas of performance:

1) Have strong mathematical content knowledge and pedagogical content knowledge to solve mathematical problem solving;
2) identify and apply heuristics and problem solving strategy in solving mathematical problems;
3) use critical thinking to connect various mathematical topics and mathematical software applications; and
4) create assessment and evaluation rubrics for mathematical problem solving.

2.2 Purposes for Developing / Revising Course (content / learning process / assessment / etc.)

Section 3 Course Structure

3.1 Course Descriptive

Heuristics approach to problem solving; problem-solving skills and strategies; problems posing and problems extension; critical thinking and decision making; PISA (Program for International Student Assessment) mathematics questions; solving word problems using bar-model methods and others; PISA-Collaborative problem solving; research on mathematical problem solving.

3.2 Time Length per Semester (Lecture – hours / Practice – hours / Self Study – hours)

Lecture	**Practice/Field Work/Internship**	**Self Study**	Remedial Class
48 hours	0	96 hours	6 (if any)

3.3 Time Length per Week for Individual Academic Consulting and Guidance

At least 5 hours / week

Individual consulting and guidance

Self-consulting at the lecturer's office:

Room Number 305, CHM Building, Nakhon Education Campus

Mon, 9.00 – 12.00

Tue: 9.00 – 12.00

Consulting via office telephone/mobile phone:

081-3432853

Consulting via email:

krongthong.kh@ssru.ac.th

Consulting via social media platform (Facebook/Twitter/Line):

None

Consulting via Computer Network (Internet/Web board):

www.elic.ssru.ac.th/

Section 4 Developing Student's Learning Outcomes

Expected students' learning outcomes are categorized into five domains, developed from curriculum specification (TQF2), as follows:

1. Morals and ethics

1.1 Learning outcomes to be developed

- 1) To have personal responsibility, corporate responsibility and moral reasoning
- 2) Can adjust to work as a team both as leader or follower and work effectively with others;
- 3) Have discipline, self, and social responsibility.

2. Teaching strategies

1) using Blended Learning and on Line Learning, lecture and group discussion
2) Using Student-centered: Problem-Based learning and Cooperative learning approaches
3) Encouraging the students to have integrity, honesty, and discipline such as unselfishness and self-control.

3. Assessment & evaluation strategies

1) Attendance record
2) Performance Assessment (on-site)
3) System log (online/on-demand)

2. Knowledge

2.1 Learning outcomes to be developed

- 1) apply mathematical content knowledge and pedagogical content knowledge to solve mathematical problem solving
- 2) Have knowledge and understanding principles and concepts of mathematical problem solving skills and mathematical problem solving strategies.
- 3) Able to apply computer dynamic software program such as the Geometer's Sketchpad and/or other program in solving mathematics problems;

2.2 Teaching strategies

1) Students are able to learn both independently and cooperatively through online learning;
2) Students learn new skills and apply Blended Learning and on Line Learning in new knowledge and unexpected situations.
3) Using brainstorming to encourage students generate many ideas and using higher order thinking.

2.3 Assessment and evaluation strategies

1) Using rubrics for complex authentic task
2) Using formative and summative tests
3) Using students' report and presentation.

3. Cognitive skills

3.1 Learning outcomes to be developed

- 1) Be able to apply knowledge learned to solve problem-based learning;
- 2) Able to create learning instruction to solve mathematics problems in corporate with The Geometer's Sketchpad; and
- 3) Able to develop instructional materials in mathematics using The Geometer's Sketchpad and/or other program including AR/AI.

3.2 Teaching strategies

1) Use internet-based learning and blended learning in using dynamic software program in mathematics.
2) Use problem-based learning in mathematics and real life problems;
3) students write reports, and able to present their findings from discussion / searching information.

3.3 Assessment and Evaluation strategies

1) Using rubrics for complex authentic task
2) Using formative and summative tests
3) Using group report and presentation.

4. Interpersonal Skills and Responsibilities

4.1 Learning outcomes to be developed

- 1) Have responsibility for assignments: select ideas in mathematical problem solving strategies from different theoretical perspectives;
- 2) effective problem-solvers, applying critical and creative thinking to a range of problems.
- 3) Can adjust to work in team both as leader or follower and work effectively with others

4.2 Teaching strategies

1) Find, acquire, evaluate, manage and use relevant information in a range of media.
2) Use internet-based learning and web-based data on business statistics; and
3) Apply cooperative learning method and Problem-Based Learning (PBL) in business statistics.

4.3 Assessment & evaluation strategies

1) Performance Assessment (on-site)
2) System log (online/on-demand)
3) Project work, group report and presentation.

5. Numerical Analysis, Communication, and Information Technology Skills

5.1 Learning outcomes to be developed

- ○ 1) Able to develop instructional materials in mathematics using The Geometer's Sketchpad and/or other program including AR/AI.;
- ● 2) Able to apply knowledge from website incorporate with dynamic software in teaching primary and secondary mathematical problem solving;
- ○ 3) Able to present well-reasoned arguments using technology as appropriate.

5.2 Teaching strategies

1) Using problem-based learning research-based learning and internet-based learning to enhance students' thinking skills.
2) Using dynamic mathematics software such as the Geometer's Sketchpad and/or other program including AR/AI;
3) Encourage the students to develop their higher thinking skills and providing diversity environments for students to construct and implement their knowledge.

5.3 Assessment and evaluation strategies

1) Using rubrics for complex authentic task;
2) Using formative and summative tests; and
3) Using individual portfolio, project work, group report and presentation.

Remark: Symbol ● means "major responsibility"

Symbol ○ means "minor responsibility"

No symbol means "no responsibility"

During of pandemic of COVID -19, teaching strategies may be changed by using Massive Open Online Courses (MOOC) prepared by lecturers and/or other educational organization.

Section 5 - Lesson Plan and Assessment

1. Lesson plan

Week	Topic/Outline	Teaching-Learning Model	Program/Teaching Strategies	Content Management	Assessment
1	• Course Outline • Pretest • Introduction to mathematical problems solving • PISA (Program for International Student Assessment)	Online	Google Meet	• GSP • PowerPoint • YouTube VDO	• Attendance Record • System log • Pretest
2	• Mathematics questions; • Heuristics approach to problem solving;	Online	Google Meet	• GSP • PowerPoint • Lecture Notes • Worksheet	• Attendance Record • System log - Quiz
3-4	• problem-solving skills • problem strategies; and • Heuristics	Online	Google Meet	• GSP • PowerPoint • Lecture Notes • Worksheet	• Attendance Record • System log - Quiz
5	• problems posing; • problems extension; and • KWL: problems solving	Online/ On Demand	Google Meet http://www.elic.ssru.ac.th/	• GSP • Lecture Notes • Worksheet	• Attendance Record • System log - Quiz
6.	• critical thinking skills and • decision making skills;	Online/ On Demand	Google Meet http://www.elic.ssru.ac.th/	• GSP • Lecture Notes • Worksheet	• Attendance Record • System log

Week	Topic/Outline	Teaching-Learning Model	Program/Teaching Strategies	Content Management	Assessment
7.	• **Project Work Assignments & Activities**	Online/ On Demand	• Google Meet http://www.elic.ssru.ac.th/ • PISA & ONET Problems	• GSP • Lecture Notes • Worksheet	• Attendance Record • System log
8.	• **Mid - Term Test** • **Project Work Assignments & Activities**	Online/ On Demand	Google Meet http://www.elic.ssru.ac.th/	• GSP • Lecture Notes • Worksheet	• Attendance Record • System log • Test
9.-10	• solving word problems using bar-model methods and others;	Online	Google Meet	• GSP • Lecture Notes • Worksheet	• Attendance Record • System log • Quiz
11	• solving word problems using stack-model methods and others;	Online/ On Demand	Google Meet http://www.elic.ssru.ac.th/	• GSP • Lecture Notes • Worksheet	• Attendance Record • System log • Assignment
13-14	• PISA-Collaborative problem solving;	Online/ On Demand/ On site	Google Meet http://www.elic.ssru.ac.th/	• GSP • Lecture Notes • Worksheet	• Attendance Record • System log • Work assignment

15	• research on mathematical problem solving	Online/ On Demand	Google Meet http://www.elic.ssru.ac.th/	• GSP • Lecture Notes • Worksheet	• Attendance Record • System log • Assignment
16	• Mark up classes • Students' Project Work Assignments & Activities			• GSP • Lecture Notes • Worksheet	
17.	**Final Examination**				

Note: Lesson plan might be affected by the COVID-19 pandemic.

2. Learning assessment plan

Learning Outcomes	Assessment Activities	Schedule (Week)	Proportion for Assessment (%)
1.1, 1.2, 1.3 2.1, 2.2, 2.3, 4.1, 4.2, 4.3 5.1, 5.3 6.1, 6.2, 6.3	1) Attendance record 2) Performance Assessment (on-site/online) 3) System log (online/on-demand) 4) Quiz	1, 3, 5, 7, 9, 11, 13, 15	40
2.2, 2.3, 5.2	Examination	17	30
3.1, 3.2, 3.3 4.1, 4.2, 4.3, 5.1, 5.2, 5.3 6.1, 6.2, 6.3	1) Criteria for assignment 2) Self-and peer assessments 3) Using group report and presentation 4) Using formative and summative tests	2, 4, 6, 10, 12, 14	30

Section 6 – Learning and Teaching Resources

1. Textbook and main documents

(1) Dynamic Software Program: The Geometer's Sketchpad

(2) Textbook:

Polya, G. (1945). *How to Solve it*. USA

Schoenfeld, A.H. (1985). *Mathematical Problem Solving*. Orlando: Academic Press, Inc.

Khairiree, K. & Tran Vui. (2021). *Discovering Mathematics: Mathematical Problem Solving* Approach 1-6. Bangkok: Pada Education Publication.

(3) Course materials provided by the lecturers

2. Important documents for extra study

Documents suggested by the lecturers

3. Suggested information (Printing Materials/Website/CD/Others)

Information retrieved from search engines (e.g., Google) and online videos

Section 7 - Course Evaluation and Revising

1. Strategies for course evaluation by students

Using a questionnaire to collect students' opinions to improve the course and enhance the curriculum. Sample questions:

(1) The Learning Management System (e.g. Moodle & Google Classroom) and social media platforms (e.g. Facebook & Line) are useful and provide accessibility to learners. Other online learning tools such as Kahoot! and Quizizz are also fun to interact with.

(2) Online contents are highly accessible and have better quality comparing with printed materials.

(3) With the Learning Management System used, students can follow up with the course and check their learning progress.

(4) Students can contact the lecturer easily using the internal messaging system, feedback system, and social networking.

(5) As this course is skill-focused, students have mathematical knowledge and skills useful to students' studying and future jobs.

…….. etc. ……

2. Strategies for course evaluation by the lecturer

The lecturer observes the class and determine if:

1) The lecturer is well prepared for class sessions.
2) The lecturer answers questions carefully and completely.
3) The lecturer uses examples to make the materials easy to understand.
4) The lecturer stimulated interest in the course.
5) The lecturer made the course material interesting.
6) The lecturer is knowledgeable about the topics presented in this course.
7) The lecturer treats students respectfully.
8) The lecturer is fair in dealing with students.
9) The lecturer makes students feel comfortable about asking question.
10) Course assignments are interesting and stimulating.
11) The lecturer's use of technology enhanced learning in the classroom.

…….. etc. ……

3. Teaching revision

The lecturer revises the teaching and learning process based on the results from the questionnaire results.

4. Feedback for achievement standards

CHM administrator committees monitor the assessment process and grading.

5. Methodology and planning for course review and improvement

1) Revise and develop course structure and process every two years.
2) Assign different lecturers to teach this course to enhance students' vision.

Curriculum Mapping Illustrating the Distribution of Program Standard Learning Outcomes to Course Level

Courses	1. Morals and Ethics			2. Knowledge			3. Cognitive Skills			4. Interpersonal Skills and Responsibility			5. Numerical Analysis, Communication and Information Technology Skills		
Course Category:	● **Major Responsibility**									○ **Minor Responsibility**					
Requirement Course Major Required Course	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
BMA2303 Mathematical Problem Solving	●	○	○	●	●	○	○	●	○	○	●	○	○	●	○

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Expected learning outcomes are combined for all types of instructional activities.