Yogyakarta State Unive

2022

CURRICULUM

MASTER OF MATHEMATICAL EDUCATION STUDY PROGRAM

DEPARTMENT OF MATHEMATICS EDUCATION, FMIPA UNY

2022

FOREWORD

The 2022 Curriculum for the Master of Mathematics Education Study Program at FMIPA UNY was compiled based on Law No. 20 of 2003 concerning National Education, Law No. 14 of 2005 concerning Teachers and Lecturers, Government Regulation No. 4 of 2022 concerning National Education Standards, Presidential Regulation No. 8 of 2012 concerning the Indonesian National Qualifications Framework (KKNI), Minister of Education and Culture Regulation No. 3 of 2022 concerning National Higher Education Standards, and the 2019 UNY curriculum development guidelines.

The process of developing the 2022 curriculum went through several stages, namely (1) Comparative Study, (2) Tracer Study, (3) Review of the 2019 Curriculum, and (4) Curriculum Design Workshop. One of the important stages was the curriculum design workshop, which was a refinement of the 2019 curriculum and was organized by the Master of Mathematics Education study program and attended by all lecturers, alumni, and graduate users with presentations by education experts in fields relevant to the Master of Mathematics Education Study Program.

The curriculum of the Master of Mathematics Education Study Program at FMIPA UNY includes scientific vision, mission, objectives, graduate competencies, a list of compulsory courses, the distribution of courses for each semester, and a map of the relationship between courses and essential learning outcomes, graduate profiles, and the vision and mission of the Master of Mathematics Education Study Program. We hope that this curriculum will significantly contribute to producing high-quality graduates at the national and international levels and facilitate the implementation of the education program.

Yogyakarta, July 26, 2022
Program Director,

Prof. Dr. Sugiman, M.Si.
NIP: 19650228 199101 1 001

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CHAPTER I
INTRODUCTION

A. Rationale

The 2022 curriculum development accommodates developments in science, technology, and the arts in the era of the Industrial Revolution 4.0, which is characterized by the Internet of Things (IoT), Critical Thinking, Communication, Collaboration, and Creativity (4C), Problem Solving, Big Data Analysis, Digitalization, and online learning. In addition, the Industrial Revolution 4.0 is also characterized by innovative products, such as artificial intelligence, robotics, autonomous transportation, 3-D printing, nanotechnology, biotechnology, new materials science, energy storage, and quantum computing. Curricula and learning need to accommodate blended learning, competency certification, Higher Order Thinking Skills (HOTS), and Outcome-Based Education (OBE). Along with this, the 2022 curriculum development also adapts to the Society 5.0 era, which is characterized by the demand for graduates with leadership, language skills, IT literacy, and writing skills.

The development of the 2022 curriculum takes into account 21st Century Education so that graduates are able to compete in the national and international job markets. Based on the UNESCO agreement, 21st Century Education not only teaches scientific material, but also various skills referred to as 21st Century Skills, including life and career skills, learning and innovation skills (4Cs), and information, media, and technology skills.

The development of the 2022 curriculum for the Master of Mathematics Education Study Program refers to the Indonesian National Qualifications Framework (KKNI) at competency level 8. This allows for the comparison, equivalence, and integration of education and job training as well as work experience. Every graduate of the UNY Master of Mathematics Education Study Program must achieve level 8 of the KKNI. Higher education curriculum development is also competency-based (KBK), as stipulated in the Minister of Education Decree No. 232/U/2000 and No. 045/U/2002. Higher education outcomes, which were originally in the form of mastery of knowledge, skills, and attitudes, have been expanded to include the competence to perform a set of intelligent, responsible actions to carry out tasks in specific fields of work.

B. Foundation for Development

1. Legal Basis

a. Law Number 20 of 2003 concerning the National Education System
b. Law No. 14 of 2005 on Teachers and Lecturers
c. Law No. 12 of 2012 on Higher Education
d. Presidential Regulation of the Republic of Indonesia No. 8 of 2012 on the National Qualifications Framework
   Indonesia (KKNI)
e. Government Regulation of the Republic of Indonesia No. 57 of 2021 concerning National Education Standards
f. Government Regulation No. 19 of 2005 concerning National Education Standards

g. Government Regulation No. 74 of 2008 on Teachers
h. Government Regulation No. 17 of 2010 concerning the Management and Implementation of Education
i. Ministry of Education and Culture Regulation No. 73 of 2013 concerning the Implementation of the Indonesian National Qualifications Framework (KKNI) in Higher Education
j. Minister of Research, Technology, and Higher Education Regulation No. 44 of 2015 concerning National Standards for Higher Education
k. Ministry of Research, Technology, and Higher Education Regulation No. 62 of 2016 concerning the Higher Education Quality Assurance System
l. Ministry of Education and Culture Regulation No. 3 of 2020 concerning National Standards for Higher Education
m. Ministry of National Education Regulation No. 16 of 2007 on Academic Qualifications and Teacher Competency Standards
Academic Qualifications and Teacher Competencies
n. Ministry of National Education Regulation No. 27 of 2008 concerning Standards Academic Qualifications and Competencies of Counselors
o. Regulation of the Minister of State for Administrative Reform and Bureaucratic Reform Number 16 of 2009 concerning Functional Positions for Teachers and Their Credit Points
p. Ministry of Research, Technology, and Higher Education Regulation No. 44 of 2015 concerning National Standards
Higher Education (SNPT)
q. Ministry of Research, Technology, and Higher Education Regulation Number 35 of 2017 concerning the UNY Statute
r. Ministry of Research, Technology, and Higher Education Regulation Number 55 of 2017 concerning Teacher Education Standards
s. Circular Letter of the Directorate General of Higher Education No. 255/B/SE/VIII/2016 on Guidelines for Curriculum Development
Higher Education
t. UNY Rector Regulation No. 1 of 2019 concerning UNY Academic Regulations
u. UNY Rector Regulation No. 41 of 2019 concerning Quality Standards, Education Standards Group
v. Rector Regulation No. 24 of 2014 on the UNY Long-Term Development Plan (RPJP) 2015–2025
w. UNY PTNBH Strategic Plan 2023–2026
x. FMIPA UNY Strategic Plan 2023–2026
y. Master's Program in Mathematics Education Strategic Plan, FMIPA UNY
z. Rector's Regulation of 2019 on the Curriculum Evaluation Guidebook of Yogyakarta State University
aa. Rector's Regulation of 2019 on the Curriculum Development Guidebook of Yogyakarta State University.

2. Philosophical Foundations

Curriculum development for study programs at UNY is based on various philosophies such as humanism, essentialism, perennialism, idealism, and social reconstructivism with the following thoughts.

a. Indonesians, as creatures of God, possess a divine nature that is inherently good; they are capable of learning and practicing to acquire knowledge and skills, and to develop intelligent, intellectual, and independent attitudes.
b. Education builds Indonesians who are fully committed to Pancasila; who are devoted to God Almighty, humane, dignified, just, democratic, and uphold social values.
c. Education equips students with knowledge, skills, and progressive attitudes so that they can exist and succeed in their lives.
d. Education takes into account the characteristics and needs of students, the needs of society, advances in science and technology, and the cultural heritage of the Indonesian nation.
e. Educators have professional competencies that include personal, social, and pedagogical competencies, as well as expertise in their respective fields of study, and they work professionally based on the principles of worship, *ing ngarso sung tuladha* (leading by example), *ing madya mangun karsa* (building character), and *tut wuri handayani (guiding from behind*).
f. Educational institutions are independent, authoritative, dignified, and fully responsible systems for educating the nation.

3. Theoretical Foundation

Curriculum development follows several principles or axioms that have been agreed upon by curriculum experts. The principles of curriculum development include the following:

a. Based on the existing curriculum

Curriculum development begins with the current curriculum, namely the 2014 Curriculum. The 2014 Curriculum has been implemented for four years and is expected to produce graduates in 2019. An evaluation of the 2014 Curriculum is necessary to identify its strengths and weaknesses. Its strengths should be carried over to the next curriculum, while its weaknesses should be improved upon, so that the 2019 Curriculum will be better.

b. Comprehensive/thorough

Curriculum development is carried out comprehensively, covering all aspects of the curriculum, such as objectives, profiles, learning outcomes, teaching materials, courses (credit load, semesters, and sequence), learning processes, assessment processes, internships, practicums, and achievement of objectives.

c. Continuous

Curriculum development is carried out continuously. The program curriculum development team conducts evaluations of the current curriculum and the results are used to improve the next curriculum.

d. Systematic

Curriculum development is carried out systematically, through clear stages in accordance with curriculum development science. These stages are explained in more detail in the curriculum development process.

e. Needs-based

Curriculum development is based on labor market needs and scientific development needs. Therefore, surveys of labor market needs, general community needs, and analysis of future needs are necessary in curriculum development.

f. Continuous

Each lecturer can evaluate their lectures and propose improvements to the program curriculum development team. Minor improvements can be made at any time, while major improvements must be made through teamwork. Thus, curriculum development can take place continuously.

CHAPTER II
PRINCIPLES AND PROCEDURES FOR CURRICULUM DEVELOPMENT

A. Principles of Curriculum Development

The development of the curriculum for the Master of Mathematics Education program at FMIPA UNY is based on the following knowledge and principles.

1. Relevance
   Curriculum and learning must be relevant to developments in science and technology, community needs, and developments of the times.
2. Continuity
   The curriculum must be continuous, with clear connections and progression.
3. Flexibility
   The curriculum should have horizontal and vertical flexibility in terms of both content and implementation process.
4. Effectiveness and efficiency
   The curriculum is designed to be effective and efficient in its implementation to achieve *the learning outcomes* that have been set within two years.
5. The curriculum that has been developed can be implemented effectively in accordance with the various conditions that exist in the study program in accordance with the 2019 Curriculum Implementation Guidelines.

B. Semester

The academic semester for the Master's Program in Mathematics Education at UNY is structured as follows:

1 Table. Semester Course Structure

Month	Semester
August-January	Odd Semester
February-July	Even Semester

C. Master's Program Curriculum

a. The Master's program curriculum is designed with consideration of:
   i. Generic KKNI level 8 for S-2.
   ii. Continuity of *learning outcomes from* S-1, S-2, and S-3.
   iii. Continuity in the progression of course materials for S-1, S-2, and S-3.

b. Master's Program Curriculum Structure
   i. The Master's Program consists of Foundation Courses (MPK), Specialization Courses (MKK), and Additional Skills Courses (MKKT). MPK are courses that provide a foundation of expertise in accordance with the study program or field

of expertise. MKK are courses that form the program's expertise core ( ). MKKT are elective courses offered by the program and can be taken by students from other programs in order to enhance their skills in other fields (multidisciplinary).

ii. The final project for the Master's degree is a thesis. This course is designed to equip graduate students with the ability to conduct research and write scientific papers in their field based on research results. This course is also intended to meet the requirements of the KKNI level 8.

iii. A program may offer more than one field of specialization or concentration.

c. Other provisions in the development of the Master's Program curriculum are as follows.

i. The credit weight for each course is a minimum of 2 credits.

ii. The credit weight for the thesis is 6 credits.

iii. Foundational Courses (MPK) include required and elective courses according to the needs of the study program.

iv. Specialized Courses (MKK) include required and elective courses in accordance with the program and concentration requirements.

v. Additional Skills Courses (MKKT) include elective courses that can be taken by students from other programs.

d. Matriculation Program

i. The Matriculation Program is a *prerequisite* course offered as an additional course to equalize the competencies of students before they enroll in educational programs at UNY. The matriculation program is intended for interdisciplinary master's students (bachelor's or master's graduates who are not from a related field). The number of credits is based on the student's educational background (related field of study).

ii. Master's programs may determine prerequisite courses for interdisciplinary master's students.

e. Study Load and Duration

The study load for the Master's Program is determined by the number of credits as follows.

i. The study load ranges from 38-44 credits with the following components.

1. MPK consists of 8 credits in the form of compulsory courses.
2. MKK ranges from 30-32 credits in the form of compulsory courses and compulsory courses that must be passed ( ) and free electives, including

thesis courses with a weight of 6 credits.

3. MKKT ranges from 2-4 credits that can be taken across programs.

Table 2. Number of credits for the Master's Program

Item	Description
MPK (credits)	8
MKK (credits)	30-32
MKKT (credits)*	2-4
Total Credits	38-44

Note: *multidisciplinary course

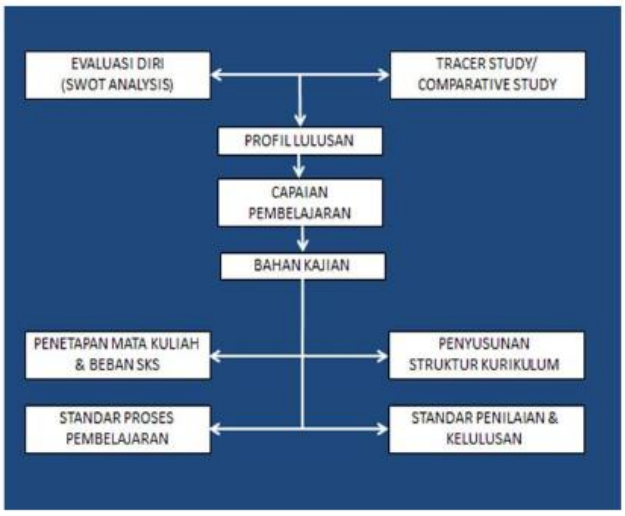
ii. Maximum duration of the Master's Program is 8 semesters

D. Curriculum Development Procedures

The curriculum development procedure for the UNY Master's Program in Mathematics Education was developed with reference to the 2008 Higher Education Competency-Based Curriculum Development Guidelines issued by the Directorate of Academic Affairs, Directorate General of Higher Education, and the LPTK Curriculum Development Guidelines. The approach used is competency-based. The curriculum development procedure includes the following steps:

1. Evaluation of the previous curriculum
2. Establishment of Graduate Profile
3. Formulation of Graduate Learning Outcomes (CPL)
4. Determination of Study Materials
5. Formulation of Courses
6. Distribution of Learning Outcomes in Courses
7. Determination of Course Weight (credits)
8. Preparation of Course Descriptions
9. Curriculum Structure Development
10. Preparation of Semester Learning Plans (RPS)
11. Determination of the Learning System
12. Determination of Assessment/Evaluation System
13. Curriculum Document Development

The thirteen stages can be seen in Figure 1 below.



1. Curriculum Development Stages

2022 CURRICULUM FOR THE MASTER OF MATHEMATICS EDUCATION STUDY PROGRAM

A. Identity of the Master's Program in Mathematics Education

University	: Yogyakarta State University
Faculty	: Mathematics and Natural Sciences
Department	: Mathematics Education
Study Program	: Master of Mathematics Education
Address	: Jl. Colombo No.1, Yogyakarta 55281,
Website	: http://s2pmat.fmipa.uny.ac.id
Email	: s2pmat@uny.ac.id
Phone	: 0274-565411

B. Vision and Mission of the Program

Academic Vision of the Master's Program in Mathematics Education

To become an outstanding, creative, and innovative program that consistently produces graduates capable of mastering, developing, and applying cognitive psychology, didactics, learning media, and research-based evaluation to enhance the quality of mathematics education with global competitiveness.

Mission of the Master's Program in Mathematics Education

1. **Providing** excellent, creative, and innovative **education** to produce graduates who are competent in mastering, developing, and applying cognitive psychology, didactics, learning media, and mathematics learning evaluation in accordance with global needs.
2. **Conducting research** oriented towards the development of mathematical education, particularly in the fields of cognitive psychology, didactics, learning media, and evaluation, to produce innovative solutions to the challenges of 21st-century mathematics learning.
3. **Conducting community service based on** mathematical education **science** to improve mathematical literacy, empower educators, and advance the quality of mathematics learning at various levels of education.
4. **Strengthening national and international cooperation networks** with educational institutions, research institutions, and international organizations to support the development of globally competitive and sustainable mathematics education.
5. Continuously **improving the quality of academic resources and services** to create an educational ecosystem conducive to innovation in mathematics education.

C. Objectives

Based on the mission that has been determined, the objectives of the Master of Mathematics Education Study Program are as follows.

1. **To produce graduates** who excel in the mastery, development, and application of mathematics education in the fields of cognitive psychology, didactics, learning media, and evaluation, who are globally competitive.
2. **Making** a real **contribution** to the development of mathematics education through innovative, applicable research that is relevant to 21st-century learning needs.
3. Making a real contribution to society through service activities based on mathematics education that empower educators and improve the quality of mathematics learning.
4. **Strengthening collaborative networks** with national and international institutions to support the development of globally competitive and sustainable study programs.
5. **Developing a quality academic ecosystem by** improving the quality of human resources, facilities, and educational services to create a conducive and innovative learning environment.

D. Graduate Profile

Graduates of the Master of Mathematics Education Program are expected to become educators, researchers, consultants, and developers in the field of mathematics education. The graduate profile is described as follows.

Table2. Graduate Profile of the Master of Mathematics Education Program

Graduate Profile	Description
Professional mathematics education educator	Mathematics education lecturer or mathematics teacher in formal and non-formal institutions
Researcher in mathematics education	Research designers and implementers as well as scientific article writers in the field of mathematics education
Mathematics education consultants	Providers of guidance, advice, or counsel in the field of mathematics education
Developers of mathematics education media and teaching materials	Designer and developer of conventional media and IT-based media in the field of mathematics education
	Designers and developers of teaching materials for mathematics education

E. Learning Outcomes for Graduates (CPL)

The competencies or Graduate Learning Outcomes of the Master's Program in Mathematics Education include the following attitudes, knowledge, and skills.

Table3. Competencies or Learning Outcomes

Every graduate of the master's program in mathematics education has the following minimum learning outcomes.
1. ATTITUDES
a. Being devout to God Almighty and able to demonstrate religious attitudes;

b. Upholding human values in carrying out duties based on religion, morals, and ethics;
c. Contribute to improving the quality of life in society, nation, and state, and the advancement of civilization based on Pancasila;
d. Acting as proud citizens who love their homeland, possess nationalism, and feel a sense of responsibility towards the state and nation;
e. Respecting cultural diversity, views, religions, and beliefs, as well as the opinions or original findings of others;
f. Cooperate and have social sensitivity and concern for society and the environment;
g. Obey the law and maintain discipline in social and state life;
h. Internalizing academic values, norms, and ethics;
i. Demonstrate a responsible attitude toward work in their field of expertise independently; and
j. Internalizing the spirit of independence, perseverance, and intellectualism.

2. KNOWLEDGE

a. Mastering mathematics material at the school and higher education levels;
b. Mastering pedagogical and didactic theories, curriculum, and assessment in the field of mathematics education;
c. Mastering the theory and practice of mathematics learning at the school and higher education levels;
d. Mastering various research theories in the field of mathematics education and data analysis techniques;
e. Understanding the development of research that has implications for the application of mathematics education;
f. Mastering various theories about models, methods, and innovative and proven learning techniques to produce professional mathematics education practices.

3. SPECIAL SKILLS

a. Able to develop teaching media and materials for mathematics education;
b. Able to disseminate the results of research and development in Mathematics Education to the community;
c. Able to solve various mathematics education problems using interdisciplinary and multidisciplinary approaches;
d. Able to manage research and development in mathematics education that is beneficial to *stakeholders* and the scientific community; and
e. Able to publish the results of research and development in mathematics education at the national and international levels in scientific forums and scientific journals;

4. GENERAL SKILLS

a. Possess logical, critical, systematic, and creative thinking skills through scientific research, the creation of works in the field of science and technology that pay attention to and apply humanities values in accordance with their field of expertise, compile scientific concepts and study results based on scientific rules, procedures, and ethics in the form of a thesis or other equivalent form, and uploaded on the university website, as well as papers published in accredited scientific journals or accepted in international journals;
b. Able to conduct academic validation or studies in accordance with their field of expertise in solving problems in society or relevant industries through the development of their knowledge and expertise;
c. Able to compile ideas, thoughts, and scientific arguments responsibly and based on academic ethics, and communicate them through the media to the academic community and the wider community;
d. Able to identify the scientific field that is the object of their research and position it within a research map developed through an interdisciplinary or multidisciplinary approach;
e. Able to make decisions in the context of solving problems in science and technology development that consider and apply humanities values based on analytical or experimental studies of information and data;
f. Able to manage, develop, and maintain a network with colleagues within the institution and the wider research community;
g. Able to document, store, secure, and retrieve research data in order to ensure validity and prevent plagiarism;
h. Able to publish academic work in accredited national scientific journals or reputable international journals;
i. Able to adapt, collaborate, create, contribute, and innovate in applying science to community life and act as a globally-minded citizen of the world;
j. Able to uphold academic integrity in general and prevent plagiarism;
k. Able to use information technology in the context of scientific development and the implementation of expertise; and
l. Able to use at least one international language for oral and written communication.

From the formulation of the Learning Outcomes above, the Essential Learning Outcomes (CPE) are formulated as follows.

4 Table. Essential Learning Outcomes (CPE) Formulation

ECL	Description
ECL 1	Realizing religious values, academic ethics, and responsibility as a manifestation of the Pancasila spirit

ECL 2	Mastering pedagogical and didactic theories, curriculum, and assessment in mathematics education
CPE 3	Demonstrating mastery of literature and concepts related to mathematics education practice
CPE 4	Demonstrating mastery of solving school mathematics problems and higher education mathematics concepts
CPE 5	Ability to critically analyze current issues in mathematics education using interdisciplinary and multidisciplinary approaches
CPE 6	Able to carry out all stages of research and development in mathematics education that are beneficial to society, *stakeholders*, and the scientific community
CPE 7	Communicate scientific findings in the field of mathematics education at forums and in journals at the national or international level
CPE 8	Possess logical, critical, systematic, and creative thinking skills
CPE 9	Demonstrating adaptability, independence, leadership, and the ability to work collaboratively

F. The Relationship Between CPE and CPL

5. The relationship between CPL and CPE

CPL / CPE		CPL																											
		I										II						III					IV						
		1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	1	2	3	4	5	1	2	3	4	5	6	7	8
CPE	1	√	√	√	√	√	√	√	√	√	√	√			√			√		√					√				√	
	2	√		√			√					√	√	√	√	√	√				√		√				√			
	3		√						√			√	√	√	√	√	√		√					√		√			√	
	4			√		√						√	√	√	√	√	√					√			√			√		
	5			√								√	√	√	√	√	√				√							√		√
	6							√		√					√			√	√	√	√	√			√					
	7							√		√					√			√	√	√	√	√			√					
	8	√			√						√		√						√				√	√	√	√	√	√	√	√
	9	√			√						√		√								√		√	√	√	√	√	√	√	√

Study Materials

1. *Pedagogical Content Knowledge*

a. Philosophy of science in mathematics education
b. Mathematics education curriculum
c. Theories of learning mathematics
d. Mathematics learning models/strategies
e. Mathematics learning assessment
f. Evaluation of mathematics education

2. *Content Knowledge*
   a. Secondary School Mathematics
   b. Higher education mathematics
3. *Technological Pedagogical Knowledge*
   a. Information and Technology (IT) Literacy
   b. Mathematics learning application programs
   c. Multimedia systems to support the mathematics learning process
   d. *Technology-Enhanced* Learning
4. Research in the field of *Technological Pedagogical Content*
   a. Quantitative and qualitative research methodologies for mathematics education
   b. Statistics and data analysis techniques
   c. Data analysis software in mathematics education research
   d. Thesis research
   e. Scientific writing

G. Distribution of Essential Learning Outcomes (CPE) in Courses

Code	Course	ECL								
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
I. Foundational Courses										
FMI8201	Philosophy of Science	√	√						√	
FMI8304	Educational Research Methodology					√	√	√	√	
FMI8202	Statistics				√		√			
II. Specialized Courses in the Study Program										
PMA6292	Mathematics Learning Strategies		√	√						
PMA8230	Number Theory and Its Applications				√				√	
PMA8201	Study of Mathematics Education Issues		√			√				
PMA8202	Digital Technology for Mathematics Learning				√			√		√
PMA8207	Mathematics Power		√	√	√					
PMA8228	Qualitative Research Methodology					√	√			
PMA8203	Psychology of Learning Mathematics		√	√						
PMA8204	Mathematics Learning Assessment		√				√			
PMA8221	Geometry				√				√	
PMA8206	Practical Work on Innovation in Mathematics Learning		√	√						

Code	Course	ECL								
		1	2	3	4	5	6	7	8	9
PMA8341	Thesis Proposal	√				√	√			√
PMA8236	Thesis Proposal Seminar	√				√	√	√		√
PMA8242	Scientific Writing	√				√		√	√	
PMA8643	Thesis	√				√	√	√		√
III. Elective Courses										
Mathematics Elective Courses										
PMA8223	Abstract Algebra				√				√	
PMA8224	Numerical Analysis				√				√	
PMA8225	Mathematical Statistics				√				√	
PMA8226	Fuzzy Set Theory				√				√	
PMA8227	Multilevel Modeling				√				√	
PMA8228	Complex Analysis				√				√	
PMA8229	Dynamic System				√				√	
PMA8222	Real Analysis				√				√	
Elective Courses in Mathematics Education										
PMA8208	Curriculum Study in Mathematics Education		√	√					√	
PMA8209	Ethnomathematics			√					√	
PMA8210	Mathematics Model			√					√	
PMA8211	Realistic Mathematics Education			√					√	
PMA8212	Individual Mathematics Learning for Adults			√					√	
PMA8213	Web-Based Media Programming			√					√	
PMA8214	Mathematics Level A			√					√	
PMA8215	Evaluation of Mathematics Education Programs		√	√					√	
IV. Matriculation Activities										
PMA6291	Mathematics Curriculum and Learning		√	√						
PMA6292	Mathematics Learning Strategies		√	√						
PMA6293	Mathematics Learning Planning		√	√						
PMA6294	Development and Production of Mathematics Learning Media		√	√						

H. Curriculum Structure and Course Distribution per Semester for the Master's Program in Mathematics Education

NO	CODE	COURSE	Semester				NUMBER OF CREDITS
			1	2	3	4	
I. FOUNDATIONAL SCIENTIFIC COURSES							
1	FMI8201	Philosophy of Science	2				

2	FMI8202	Statistics	2				
3	FMI8304	Research Methodology in Education		3			
Number of credits for Scientific Foundation Courses			**4**	**3**	**0**	**0**	**7**
II. SPECIALIZATION COURSES OF THE STUDY PROGRAM							
1	PMA8201	Study on Issues in Mathematics Education	2				
2	PMA8202	Digital Technology in Mathematics Learning	2				
3	PMA8203	Psychology of Mathematics Learning	2				
4	PMA8204	Assessment of Mathematics Education		2			
5	PMA8205	Innovative Mathematics Learning Strategy	2				
6	PMA8206	Practicum on Innovation in Mathematics Instruction		2			
7	PMA8207	Mathematical Power		2			
8	PMA8221	Geometry		2			
9	PMA8222	Real Analysis	2				
10	PMA8341	Thesis Proposal			3		
11	PMA8242	Scientific Paper Writing			2		
12	PMA8643	Thesis				6	
Number of credits for Specialized Courses in the Study Program			**10**	**8**	**5**	**6**	**29**
III. ELECTIVE COURSES *)							
1	Elective Mathematics Courses			2			
2	Elective Courses in Mathematics Education			2			
Number of credits for Elective Courses in the Study Program			**0**	**4**	**0**	**0**	**4**
TOTAL CREDITS REQUIRED			**14**	**15**	**5**	**6**	**40**
IV. LIST OF ELECTIVE COURSES							
NO	**CODE**	**COURSE**	**SEM & SKS**				**TOTAL CREDIT HOURS**
			1	**2**	**3**	**4**	
Mathematics Groups Offered							
1	PMA8223	Abstract Algebra		2			
2	PMA8224	Numerical Analysis		2			
3	PMA8225	Mathematical Statistics		2			
4	PMA8226	Fuzzy Set Theory		2			
5	PMA8227	Multilevel Modeling		2			**2**
6	PMA8228	Complex Analysis		2			
7	PMA8229	Dynamic System		2			
8	PMA8230	Number Theory and Its Applications		2			
Total credits for Mathematics Elective Courses			**0**	**16**	**0**	**0**	
Mathematics Education Groups Offered							

1	PMA8208	Curriculum Analysis in Mathematics Education		2			**2**
2	PMA8209	Ethnomathematics		2			
3	PMA8210	Mathematical Modeling		2			
4	PMA8211	Realistic Mathematics Education		2			
5	PMA8212	Adult Individual Mathematics Learning		2			
6	PMA8213	Web-Based Media Programming		2			
7	PMA8214	Level A Mathematics		2			
8	PMA8215	Evaluation of Mathematics Education Program		2			
Number of credits for Mathematics Education Elective Courses			**0**	**16**	**0**	**0**	

V. MATRICULATION ACTIVITIES **)	
Activity 1	Mathematics Curriculum and Instruction
Activity 2	Mathematics Learning Strategies
Activity 3	Mathematics Learning Planning
Activity 4	Development and Production of Mathematics Learning Media

DESCRIPTION:

*) Students must select one course from the Mathematics group and one course from the Mathematics Education group.

**) The Matriculation Activity is mandatory for students who come from a non-mathematics education undergraduate program.

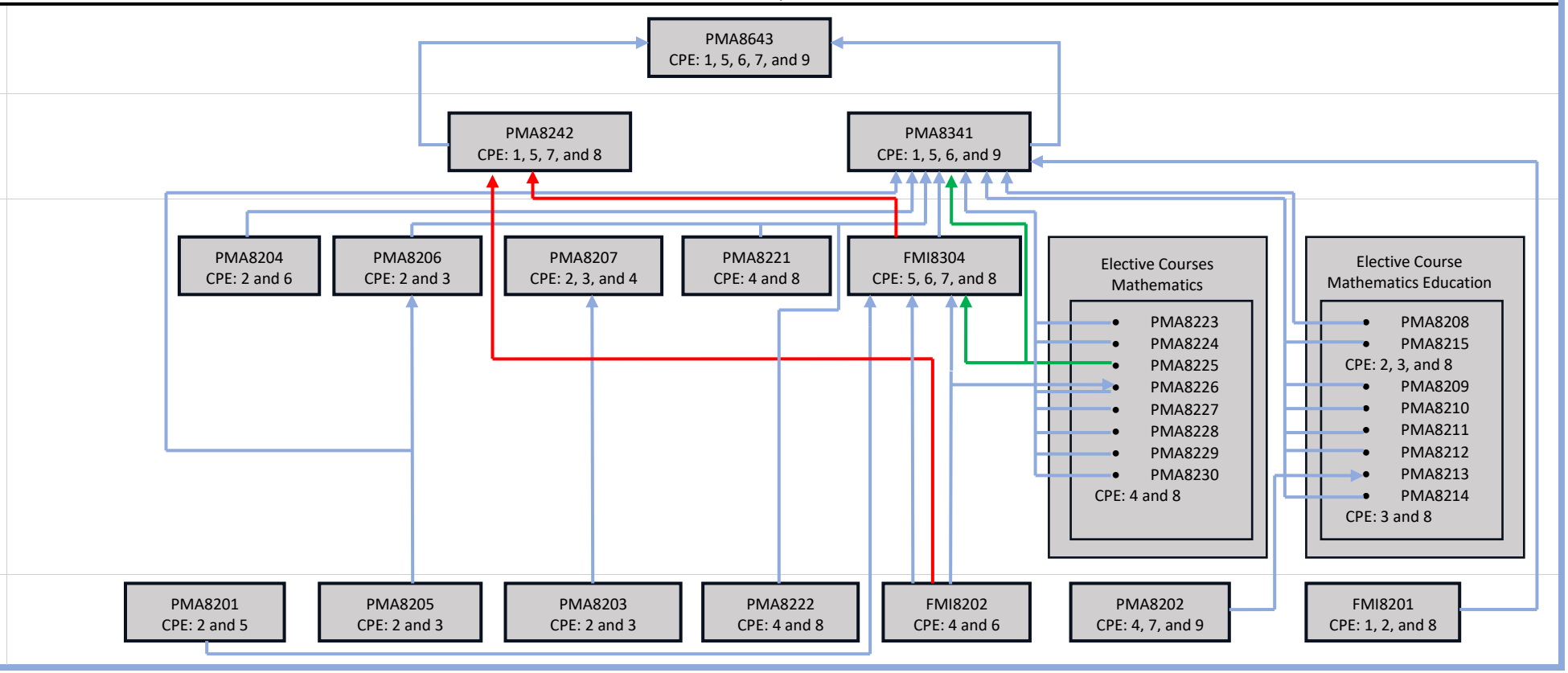
To ensure the achievement of Graduate Competencies, students from non-mathematics education undergraduate programs who are not from Mathematics or Statistics undergraduate programs are required to take 8 credits of complementary courses consisting of 4 credits of Mathematics elective courses and 4 credits of Mathematics Education elective courses.

Curriculum Map for the Master's Program in Mathematics Education, FMIPA UNY

To become a program that excels in creativity and innovation, continuously producing graduates who are able to master, develop, and apply cognitive psychology, didactics, learning media, and research-based evaluation to improve the quality of mathematics learning with global competitiveness.

Graduate Profile

(1. Professional mathematics educators; 2. Mathematics education researchers; 3. Mathematics education consultants; 4) Developers of mathematics education media and teaching materials)



I. Course Description

The course description for the Master's Program in Mathematics Education is as follows.

No. 1	FMI8201 - Philosophy of Science	2 credits	Prerequisites: -
The Philosophy of Science course covers: (1) Key Issues in the Development of Science, (2) Characteristics of Science, (3) Objects of Science, (4) Methods of Scientific Development, (5) Tools of Scientific Development, (6) History of Scientific Development, (7) Pre-Assumptions and Basic Assumptions of Science Development, (8) Sources and Limits of Science Development, (9) Justification of Science, (10) Principles of Science Development, (11) Various Schools of Thought on Science Development, including (a) absolutist and fabilist views on mathematics, (b) mechanistic, empirical, structuralist, and empirical views on mathematics education, (12) Ontology of Science, (13) Epistemology of Science, and (14) Axiology of Science, (15) Philosophy of Mathematics, and (16) Philosophy of Mathematics Education.			
No. 2	FMI8202 – Statistics	2 credits	Prerequisites: -
This course studies the concepts and aspects of multivariate analysis, random matrices and vectors, multivariate analysis for comparing several mean vectors, multivariate analysis of variance, assumptions in multivariate analysis of variance, multivariate analysis of covariance, and assumptions in multivariate analysis of covariance.			
No. 3	FMI8304 - Educational Research Methodology	3 credits	Prerequisites: -
This course discusses quantitative and qualitative research methodologies. Quantitative research methodology material covers the domain of educational research, types of educational research, the basics of educational research, research problems, research variables, theoretical studies of learning resources, hypothesis formulation (if any), sampling techniques, research indicators and instruments, instrument validity and reliability, research data analysis techniques, and research result reporting, and review of research results in the form of reports and mathematics education research journals. Qualitative research methodology material includes the basics of qualitative research methods, the development of assumptions in qualitative research, various types of qualitative research methods, principles and procedures of qualitative research, data collection techniques in qualitative research, data analysis techniques in qualitative research, and reviewing various qualitative research reports using qualitative descriptive methods, action research, design research, case studies, ethnography, and historical research.			
No. 4	PMA8201 - Study of Mathematics Education Issues	2 credits	Prerequisites: -
This course discusses various issues in mathematics education. These issues include (1) student cognition issues, (2) student differences issues; (3) curriculum issues, (4) learning approach, strategy, or method issues; (5) school and university student performance issues; (6) classroom management issues; (7) evaluation issues; and (8) research results. This course equips students with the ability to identify problems in mathematics education and determine strategies for solving them.			
No. 5	PMA8202 – Digital Technology in Mathematics Education	2 credits	Prerequisites: -
The material covered in this course includes: 1) issues of IT integration in mathematics learning; 2) IT software and applications for mathematics learning; 3) review of IT-based learning applications and media; and 4) creation of IT-based applications to assist mathematics learning and developing mathematics learning plans using the applications that have been developed.			
No. 6	PMA8203 – Psychology of Mathematics Learning	2 credits	Prerequisites: -
The Mathematics Learning Psychology course covers the basic principles of information processing that support meaningful learning. This includes the formation of mathematical concept , ideas from schemas, types *of imagery*, the process of constructing mathematical information into mathematical knowledge, and strategies for encoding and *retrieving* knowledge. The topics of learning difficulties			

studied include how to diagnose difficulties in learning mathematics, how to diagnose difficulties in problem solving, and how to remediate. This includes why some mathematical material is difficult to learn and understand from the perspective of *cognitive load and social-cognitive* factors *(self-belief about intelligence, self-belief about knowledge, self-direction, self-efficacy, self-esteem*, and *metacognitive skills)*. The problem-solving topics examined include solution procedures, how to develop *problem-solving expertise,* and the ability to transfer learning outcomes to higher-level thinking. In addition, factors that influence the mathematics learning process and various types of intelligence are also examined.			
No. 07	PMA8204 – Mathematics Learning Assessment	2 credits	Prerequisites: -
This course examines learning assessment and its application in learning, particularly mathematics learning, including the use of assessment/evaluation results. The material studied includes concepts of testing, measurement, assessment, evaluation, the relationship between evaluation and learning, types of assessment including authentic assessment, determining validity and reliability, item analysis (practical, theoretical/qualitative and empirical, manually or using relevant item analysis programs), as well as the preparation and development of instruments for learning assessment/evaluation, improvement of mathematics learning, or mathematics education research.			
No. 08	PMA8205 – Innovative Mathematics Learning Strategies	2 credits	Prerequisites: -
This course covers the nature of mathematics and school mathematics, the philosophy of mathematics learning, theories of mathematics learning, innovative mathematics learning models/approaches/strategies/methods, strategies for developing students' thinking and character skills, innovative mathematics learning management, and designing teaching materials to develop specific mathematical skills based on innovative learning models/approaches/strategies/methods.			
No. 09	PMA8206 – Mathematics Learning Innovation Practicum	2 credits	Prerequisite: PMA8205
This course focuses on learning/research practices in schools or colleges. The material covered includes various innovations in mathematics learning (such as innovative learning models, innovative learning strategies, innovative learning media, and ICT-based learning), types or methods of research (such as classroom action research and quasi-experimental research), research plans to be carried out, learning implementation plans, and research data collection instruments, implementation of learning/research in schools, learning reflections, and seminars on the process and results of research analysis.			
No. 10	PMA8207 – Mathematics Power	2 credits	Prerequisites: -
This course examines three main aspects of mathematical power, namely: thinking processes (*process standards*), *mathematical abilities*, and an overview of mathematical topics (*content strands*). Thinking processes include *conceptual understanding* and *procedural knowledge*. Mathematical abilities include *problem solving*, *reasoning*, *communication*, *connections*, and *representation*. These two aspects of mathematical power will be linked to the discussion of mathematical topics (*content strands)*.			
No. 11	PMA8221 – Geometry	2 credits	Prerequisites: -
This course studies axiomatic/deductive methods and their application in geometry. The material covered includes Euclidean geometry and non-Euclidean geometry in a deductive and *rigorous* manner.			
No. 12	PMA8222 – Real Analysis	2 credits	Prerequisites: -
The Real Analysis course covers the fundamentals of analytical mathematics related to differentials and integrals. Topics ^{in} differentials in R^1 include derivatives, the interior maximum theorem, the role theorem, the mean value theorem, L'Hopital's rule, Taylor's theorem, and the interchange of			

limits and derivatives. Topics in Riemann integration in R(1) include the definition of Riemann integration and its generalizations, Riemann integrable functions, fundamental theorems, and related theorems.			
No. 13	PMA8341 – Thesis Proposal	3 credits	Prerequisite: FMI8304
This course covers thesis proposal writing and concludes with a thesis proposal seminar. The material covered includes the Thesis Proposal Writing Guide, scientific writing rules, research topic selection, introduction writing, theoretical review writing, research methodology writing, reference writing, and research instrument writing. The development and writing of the Introduction to the Research includes: (1) Identification of the problem and background of the research, (2) Formulation of the research problem and objectives, (3) Formulation of the research title, and (4) Description and formulation of the research framework. The preparation of the Theoretical Review section includes: (1) Exploration and management of formal legal references, (2) Normative references to hypotheses, (3) Normative empirical references, and (4) Empirical references to build a theoretical foundation/literature review. Developing and writing the Research Methodology section includes: (1) Research Design, (2) Instrument Development, (3) Instrument Validation, (3) Data Collection Techniques, and (4) Data Analysis Techniques.			
No. 14	PMA8242 – Scientific Writing	2 credits	Prerequisites: -
The Scientific Writing course covers material on: (1) types of scientific works, (2) reference management using *a reference manager*, (3) citation and reference writing, (3) scientific article structure, (4) writing an introduction, (5) writing methods, (6) writing results and discussion, (7) writing conclusions and suggestions, titles and abstracts, (9) scientific article writing style, and (10) scientific article writing practice.			
No. 15	PMA8643 – Thesis	6 credits	Prerequisite: PMA8341
A thesis is a final assignment prepared by students as a form of scientific work in the field of mathematics education. The thesis is prepared based on the knowledge and skills acquired in previous courses and is carried out in accordance with the rules of scientific research. As a continuation of the Thesis Proposal course, the Thesis course focuses on the preparation and testing of valid research instruments, research data collection, data analysis, drawing conclusions, writing thesis research reports, thesis examinations, and writing articles.			
No. 16	PMA6291 – Mathematics Curriculum and Instruction	2 credits	Prerequisites: -
This course discusses the definition of curriculum, curriculum concepts including curriculum as a lesson plan, curriculum as an experience, curriculum as learning outcomes, curriculum dimensions, and curriculum functions and roles. Curriculum foundations include: philosophical foundations, psychological foundations, sociological foundations, and technological foundations. Curriculum as a system, characteristics of a system, curriculum components including objectives, materials, strategies, and evaluation. Curriculum organization models, namely: Humanistic Model, Academic Subject Model, Social Construction Model, and Technological Model. The concepts and principles of the curriculum currently used in secondary schools in Indonesia, in this case the 2013 Curriculum, learning models in line with the 2013 Curriculum, Education Standards, the learning evaluation system in line with the 2013 Curriculum, learning principles, such as the principles of activity, efficiency, effectiveness, individuality, direct involvement, motivation, reinforcement, cooperation, and others, components of objectives, material, strategy/method, media, and evaluation, learning design concepts, learning design models, syllabus and lesson plans (RPP), the essence of curriculum and learning innovation. In this course, students also observe the implementation of the mathematics curriculum in secondary schools, write reports, and present their findings.			

No. 17	PMA6292 – Mathematics Learning Strategies	2 credits	Prerequisites: -
This course discusses mathematics learning models, constructivism approaches, contextual approaches, realistic approaches, mathematics learning strategies, mathematics methods, mathematical attitudes, *mathematical thinking* and *higher order thinking*, mathematics teacher competencies, and simulates various mathematics learning models in accordance with the applicable curriculum.			
No. 18	PMA6293 – Mathematics Instructional Planning	2 credits	Prerequisites: -
This course discusses content standards, graduate competency standards, assessment standards, process standards, the preparation of learning implementation plans, and the preparation of indicators, questions, and question grids for junior high school/MTs, senior high school/MA, and vocational high school mathematics tests. Students will also develop learning tools that include syllabi, lesson plans, teaching materials, media, evaluation instruments, and worksheets based on relevant Ministry of Education regulations for use in secondary school mathematics learning.			
No. 19	PMA6294 - Development and Production of Mathematics Learning Media	2 credits	Prerequisites: -
The Mathematics Learning Media course covers the definition of learning media, the role and functions of learning media, types of learning media, planning and selection of learning media, production techniques for learning media, presentation techniques for learning media, and evaluation of learning media, specifically focused on mathematics education. The discussions are supplemented with practical exercises in designing and producing various types of media suitable for student characteristics.			
No. 20	PMA8223 – Abstract Algebra	2 credits	Prerequisites: -
The Abstract Algebra course equips students to explore concepts and sharpen their reasoning about groups, normal subgroups, permutation groups, cyclic groups, Lagrange's Theorem, factor groups, group homomorphisms, group isomorphism theorems, Sylow's Theorem, and their applications.			
No. 21	PMA8224 – Numerical Analysis	2 credits	Prerequisites: -
The Numerical Analysis course studies the basics of numerical computation and error, the use of numerical computation to find the roots of nonlinear equations, the solution of linear equation systems, and various polynomial interpolations and their error measurements, approximations, numerical differentials, and numerical integration. All of these topics are implemented using programming.			
No. 22	PMA8225 – Mathematical Statistics	2 credits	Prerequisite: FMI8202
This course covers the definition of probability, random variables and their distributions, properties of random variables, joint distributions of random variables, random variable functions, random variable transformations, order statistics, limit distributions, sampling distributions, point estimators of a parameter and their properties, properties of estimators, sufficiency and completeness of statistics, and properties of sufficiency.			
No. 23	PMA8226 – Set Theory	2 credits	Prerequisites:
Students are able to explain the basic concepts of fuzzy sets, fuzzy operations, fuzzy relations, and fuzzy logic, and are able to apply them to solve related problems.			
No. 24	PMA8227 Multilevel Modeling	Credits: 2	Prerequisites: FMI8202
This course covers linear models, multilevel data structures, fitting two-level models, fitting three-level and higher-level models, longitudinal data analysis with multilevel models, graphing multilevel data, generalized linear models, and multilevel generalized linear models.			
No. 25	PMA8228 - Complex Analysis	2 credits	Prerequisites: -

The Complex Analysis course covers sequences and series of complex numbers and complex-valued functions, theorems related to series such as Taylor series and Laurent series, power series, types and properties of convergence of power series, multiplication and division of power series. Additionally, it covers residues and poles along with their properties and types, as well as the application of residues to evaluate improper integrals of real functions, improper integrals in Fourier analysis, and definite integrals involving sine and cosine.			
No. 26	PMA8229 Dynamic Systems	2 credits	Prerequisites: -
The Dynamic Systems course covers autonomous differential equations and systems, dynamic systems, equilibrium solutions and periodic solutions and their stability, scalar mappings, fixed points and periodic points and their stability. In addition, it also covers the concept of bifurcation, which is a change in the structure of the orbit of a differential equation containing a parameter when the parameter is varied.			
No. 27	PMA8230 – Number Theory and Its Applications	2 credits	Prerequisites: -
The Number Theory course discusses concepts related to Number Theory and applies them to related problems such as solving Diophantine equations, problems related to congruences, primitive roots, and cryptography.			
No. 28	PMA8208 – Curriculum Studies in Mathematics Education	2 credits	Prerequisites:
This course examines the philosophical foundations, curriculum framework, basic principles, process standards, content standards, assessment standards, and student achievement in mathematics curricula implemented in several countries. The results of this study are then compared to obtain comprehensive formulations.			
No. 29	PMA8209 – Ethnomathematics	2 credits	Prerequisites: -
In the Ethnomathematics course, preliminary research related to ethnomathematics at artifact sites in the context of mathematics learning is discussed and carried out; ethnomathematics-based mathematics learning is simulated; and further research on ethnomathematics is conducted to obtain or produce articles or publications in journals.			
No. 30	PMA8210 - Mathematical Modeling	2 credits	Prerequisites: -
The Model Mathematics lecture covers: (1) Ontology and Epistemology of Various Models: Idealistic Models consisting of Classical, Modern, and Contemporary; Realistic Models consisting of Classical, Modern, and Contemporary; and Modern and Contemporary Hermeneutic Models. (2) Development and Implementation of Mathematical Models in the field of mathematics education, specifically detailed into (a) modeling and application in mathematics education; (b) *modeling* competences; (c) *modeling pedagogy*; (d) *modeling tasks*; (e) modeling in secondary schools; (f) modeling in elementary schools; (g) obstacles and challenges in modeling learning; (h) PISA; (i) mathematical modeling and ICT.			
No. 31	PMA8211 – Realistic Mathematics Education	2 credits	Prerequisites:
The Realistic Mathematics Education (RME) course discusses the history, theory, principles, and characteristics of RME. This course also explores principles in meaningful contexts, the process of mathematization, modeling rules by students, the principle of interconnection, RME-based learning pathways, and their implementation in schools.			
No. 32	PMA8212 – Individual Adult Mathematics Learning	2 credits	Prerequisites:
This course examines current research on mathematics learning in adults (*adult learning mathematics*). Topics covered include classroom methods, classroom materials, institutional support, vocational education and the world of work, and professional development. However, this course emphasizes mathematics learning for prospective mathematics teachers.			

No. 33	PMA8213 – Web-Based Media Programming	2 credits	Prerequisite: PMA8202
Course materials include: introduction to the PHP programming language, PHP structure, variables, data types and constants, form submission (POST/GET), arithmetic operators, assignment operators, comparison operators, logical operators, using array variables, conditions (IF, ELSE, SWITCH), loops (FOR, WHILE, FOREACH), creating functions, introduction to MySQL, creating databases, creating database tables, SQL commands, connecting databases with PHP, submitting forms to databases, displaying data from databases, OOP in PHP, and using web programming frameworks.			
No. 34	PMA8214 – Mathematics Level A	2 credits	Prerequisites: -
The Mathematics Level A course covers mathematics contained in the syllabus or curriculum for the Cambridge University entrance exam or affiliated exams. There are two dominant topics, namely pure mathematics and statistics/probability. In addition, it also covers how to create *a marking scheme* for an exam/test question that is equivalent to the test in English.			
No. 35	PMA8215 – Evaluation of Mathematics Education Programs	2 credits	Prerequisites
The Mathematics Education Program Evaluation (EPPM) course material covers education program evaluation, EPPM basics, EPPM models, program studies, EPPM design, EPPM instrument and criteria development, evaluation site determination, quantitative and qualitative data analysis, analysis result interpretation, analysis result reports, and EPPM report reviews.			

J. Learning System

The learning process is carried out in accordance with the 2019 Academic Regulations, namely:

1) Lectures are conducted using the Semester Credit System.
2) The study load and credits that students must complete are expressed in semester credit units, abbreviated as sks.
3) There are three types of semesters at UNY, as follows.
    a. The odd semester runs from September to January of the following year.
    b. The spring semester is held from February to August of the current year.
    c. The summer semester runs from July to August of the current year.
4) The number of face-to-face lectures is 16 (sixteen) times per semester, excluding final exams.
5) Classes can be conducted using *blended learning* or *a* full *e-learning model*.
6) The implementation of lectures using *blended learning* or full *e-learning models* is regulated by the Rector's Regulations.
7) The implementation of Master's and Doctoral programs is carried out through lectures and research.
8) Students are required to attend at least 75% (seventy-five percent) of the lectures for each course in a semester, as stated in paragraph (1).
9) Student absences due to illness or the performance of duties accompanied by a letter of explanation or permission that can be accounted for are counted as attendance.
10) Students who do not meet the 75% (seventy-five percent) attendance requirement are not eligible to take the final exam, and the students concerned will be given an E grade.
11) Final exams are conducted simultaneously according to the academic calendar.

12) Students are required to complete course evaluations for each course they take through the website https://emonev.lppmp.uny.ac.id/.

K. Assessment

The methods of assessment and determination of final grades are as follows.

1) The determination of a student's academic ability includes knowledge, skills, and attitudes/character that reflect the student's competence.
2) Learning outcomes are assessed using various approaches in accordance with the competencies that students must master.
3) The final grade for a course uses a scale of 0 (zero) to 100 (one hundred) with a passing grade of 56 (fifty-six).
4) Final grades are converted into letters A, A-, B+, B, B-, C+, C, D, and E, with the following standards and weights.

Nilai Akhir	Konversi	
Skala 100	Huruf	Bobot
86 - 100	A	4,00
81 - 85	A-	3,67
76 - 80	B+	3,33
71 - 75	B	3,00
66 - 70	B-	2,67
61 - 65	C+	2,33
56 - 60	C	2,00
41 - 55	D	1,00
0 - 40	E	0,00

L. Semester Learning Plan

The RPS can be accessed online via the website rps.uny.ac.id