

DOCUMENT OF CURRICULUM 2016

UNDERGRADUATE PROGRAMME OF MATHEMATICS



FACULTY OF MATHEMATICS AND NATURAL SCIENCES
UNIVERSITAS GADJAH MADA

2018

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1.1 MATHEMATIC STUDY PROGRAMME

1.1.1 Introduction

The Curriculum 2016 of the Undergraduate Programme of Mathematics UGM (UP-Math) is based on

1. Curriculum 2011 of UP-Math.
2. Government regulations and stakeholders.
3. Evaluation from the Semester Coordination Team (TKS), which is performed at least twice each semester. The TKS involves representatives of lecturers and students.
4. General evaluation of the UP-Math, which is done every 5 years.
5. Curriculum benchmarking of some similar mathematics study programmes of institutions in the country and abroad.
6. Input from alumni and graduate users.
7. General ASIIN Criteria.

The preparation of the Curriculum 2016 of UP-Math was conducted in several stages. The first stage was done by several meetings at the study programme level and followed by a meeting at the department level. The results of the meeting at the department level were continued to the faculty level where the final results were submitted to the faculty senate for study and approval.

1.1.2 Vision

In 2025, the UP-Math becomes an outstanding Study Programme of Mathematics, recognized and leading nationally and internationally in theory and its applications.

1.1.3 Mission

To fulfill the vision, UP-Math has four missions, namely

1. Develop learning activities through new innovations to improve the quality, efficiency and relevance of mathematics learning.
2. Develop the research culture in groups of expertise to support mathematical research and its applications.
3. Develop the role and applications of mathematics in various fields, to make a mutually beneficial cooperation between the UP-Math and mathematics user.
4. Make UP-Math as a study programme that has a credible, transparency, accountable, responsible, and fair management system.

1.1.4 Programme Education Objectives (PEO)

General Objectives:

1. To increase performance of the UP-Math in order to be nationally leading and internationally competitive.
2. To build a scientific society that are devoting to God Almighty, Pancasila minded, high integrated; insightful, creative, innovative, and responsive to society change melalui through Tri Dharma Perguruan Tinggi.
3. To cultivate collaboration with government, other high education institutions in general and among mathematics study programmes, both domestic and foreign.
4. To objectify a study programme with a good, efficient and productive governance.

Special Objectives:

To produce graduates who

- PEO 1 : have profound knowledge in theory of (pure) mathematics as the core and able to apply the theory to solve problems related to differential equations and optimization.
- PEO 2 : are adaptive and able to continue to the next programme in mathematics or in other fields related to Mathematics.
- PEO 3 : are literate in information technology and excellent in mathematical computational and have ability to follow the development of sciences and technology.
- PEO 4 : have responsibility, confidence, emotional mature, ethics, and lifelong learner principle.

The Programme Educational Objectives of UP-Math have been formulated by considering the framework of National curriculum as stated in Level 6 of the Indonesian Qualifications Framework (IQF) / KKNi (Kerangka Kualifikasi Nasional Indonesia), i.e.,

1. Capable to apply science, technology and art within her/his expertise and adaptable to various situations faced during solving a problem.
2. Mastering in-depth general and specific theoretical concepts of a certain knowledge and capable to formulate related problem solving procedure
3. Capable to take strategic decision based on information and data analysis and provides direction in choosing several alternative solutions.
4. Responsible for her/his own job and can be assigned to take responsibility of the attainment of organization's performances

Mapping of the Programme Objectives of UP-Math and IQF Level 6

IQF Level 6 \ PEO	IQF 1	IQF 2	IQF 3	IQF 4
PEO 1	H	H	M	L
PEO 2	M	H	H	M
PEO 3	H	L	M	L
PEO 4	L	L	M	H

H = High, M = Medium, L = Light

1.1.5 Target

1. Making improvements and adjustments to the relevance, competence, and efficiency of UP-Math continuously.
2. Improving services to the community in the field of research, training, consultation, service, and others.
3. Able to produce national and international publications.

4. Establishment of a national and international accredited study programme management system.

1.1.6 Strategy for achieving the objectives is as follows:

1. Making improvements and adjustments to the relevance, competence, and efficiency of UP-Math continuously. It is done by:
 - a. The efforts to increase the CGPA of Graduates, the increase of the percentage of on-time graduation, the percentage increase of the number of graduates with $CGPA \geq 3.00$, and the decrease of the average length of study through:
 - i. Improvement of teaching-learning process and final task supervision
 - ii. Improvement of learning facilities
 - iii. Assessment standardization.
 - iv. Tutorials for important courses and graders for basic courses.
 - v. Excavation of lecturer-student feedback.
 - vi. Enhancement of supervision intensity.
 - b. Encouraging lecturers to become the members of mathematical organizations in related to their research fields (HPA, Kamindo, etc.), national organization of mathematical profession (IndoMS), and international organizations.
 - c. Encouraging lecturers to attend seminars, workshops and conferences, both national and international.
 - d. Providing funding provides funding for participation in scientific forums through the Departemen of Mathematics.
2. Improving services to community such as, training, consultation, service, and others related to the research field.
 - a. Improving cooperation with other institutions.
 - b. Improving the community service as the mathematical user.
3. Able to produce national and international publications.
 - a. Encouraging lecturers to publish their research in national and international journals on mathematics.
 - b. Encouraging lecturers to attend national and international seminars by providing financial support.
 - c. Providing incentive of scientific publications through the Departemen of Mathematics.
 - a.
4. Establishment of a national and international accredited study programme management system.
 - a. Preparing facilities and infrastructure in English that support learning process.
 - b. Applying international accreditation (ASIIN).
 - c. Re-applying national accreditation through BAN PT or LAM.
 - d. Implementing quality culture through Internal Quality Audit (AMI) KJM UGM.
 - e. Cooperating with university in the country and abroad to improve the quality of study programme.

Target within the next 5 years in improving academic efficiency.

	2015 (baseline)	2016	2017	2018	2019	2020	
GPA Average	2,94	2,97	3,00	3,02	3,05	3,10	
Length of study average (year)	5,30	5,20	5,10	5,00	4,90	4,80	
On Time Graduation	9,46%	12,5%	15%	17,50%	20%	22,50%	
GPA \geq 3	45%	50%	52,5%	55%	57,5%	60%	
b. Strategies to increase graduates' GPA, percentage of on time graduation, percentage of graduates with GPA \geq 3,00 and to decrease the length of study are through:		a) Improvement on the teaching learning method and undergraduate thesis supervision b) Improvement on teaching learning facilities c) Assessment standardization. d) Organizing tutorials for important courses and providing graders for basic courses. e) Asking feedback from lecturers and students. f) Increasing supervision intensity g) Enhancing the role of and improving cooperation with GALATIKA. h) Form a team membered by users and alumnae to give some feedback and evaluation on the Curriculum and Graduates' Competence i) Using logbook for undergraduate thesis supervision					
Particular quality target are given as follows:							
Nr	Target	2015 (baseline)	2016	2017	2018	2019	2020
1	Understanding on Vision Mision and Objectives (Scale 0 - 5)						
	Lecturers	4,25	4,30	4,41	4,50	4,63	4,75
	Staffs	4,00	4,10	4,20	4,30	4,40	4,50
	Students	3,25	3,30	3,36	3,42	3,80	4,30
	Strategies	1. Evaluation and formulation of vision, mission and objectives is conducted in programme meetings. 2. Socializing of vision, mission and objectives to lecturers, students and staffs directly or indirectly through website, banner, leaflet. 3. Involving staffs on preparing manual procedures that are suitable with the main task of the staff.					
2	Competitiveness (Ratio of accepted student number and applicants)	8,55%	7,5%	6,5%	5,5%	4,5%	3,5%
	Strategies	1. Sozializing the programme to prospective high schools 2. Increasing the number of community service activities 3. Optimizing website as mediato promote the programme					
3	Percentage of dropout students	4%	3,75%	3,5%	3%	2,7%	2,5%
	Strategies	1. Improvement on cooperation with fellowship providers 2. Optimizing supervision by academic advisors and undergraduate thesis supervisors 3. Improvement on interactive teaching. 4. Providing tutorials dan graders. 5. Conducting <i>Carrier Day</i> or <i>Studium Generale</i> involving users and alumnaeto improve students performance and motivation 6. Conducting meet and greet for students and lecturers in every semester					

4	Student satisfaction on the program service (Scale 0 – 100)	70	75	77	80	85	90
	Strategies	1. Improvement of service quality, particularly for punctuality and hospitality 2. Complement Manual Procedures 3. Enhancing the intensity of supervision by academic supervisor or undergraduate thesis supervisor					
5	Percentage of Courses with RPKPS	100%	100%	100%	100%	100%	100%
	Percentage of Courses with Module Handbooks	-	90%	100%	100%	100%	100%
	Strategies	1. Evaluation on RPKPS annually to compliance the sillaby, assessment method, and supporting facilities with teaching innovation 2. Conducting workshops on learning outcomes or course outcomes					
6	Renewal of References						
	Handouts	0	5	10	10	14	18
	Textbook	2	4	5	6	6	7
	Strategies	1. Through Department of Mathematics giving grants for handouts or textbooks writing 2. Encouraging lecturers to write proposal for any handout and textbooks grant offered by UGM or Research Technology and Higher Education Ministry of Republic of Indonesia 3. Encouraging lecturers to write textbooks to be submit at some publishers					
7	Percentage of slides in English	-	25%	75%	80%	85%	90%
	Strategies	1. Proposing internasional accreditation ASIIN 2. Providing incentive for slides in English (through Dept. of Mathematics) 3. Encouraging lecturers to use English in teaching learning process					
8	Percentage of Portofolios	-	20%	50%	75%	80%	100%
	Strategies	1. Conducting evaluation on the CO – PLO achievement at the end of each semester and follow up in the following years. 2. Providing Incentive for portofolios through Dept.of Mathematics					
9	Curriculum Update	Minor Revision	Major Revision	Minor Revision	Minor Revision	Minor Revision	Minor Revision
	Strategies	1. Continuously encompassing feedback from alunae and users, directly or via email or questionnaire 2. Form a team membered by users and alumnae to give some feedback and evaluation on the Curriculum and Graduates' Competence 3. Conducting curriculum benchmarking at universities, domestic or abroad. Doing evaluation and minor curriculum revision annually 4. Conducting evaluation and or revision of curriculum at least once in five years.					
10	Number of Student Achievement (ON MIPA PT, PkM, etc.)						
	National	8	11	12	13	14	15
	International	1	2	2	2	2	2
	Strategies	1. Improvement on interactive teaching 2. Conducting selection and mentoring students for preparation of mathematics olimpiad, e.g. ON MIPA PT, Mag-D, OSN-PTI, etc. 3. Together with Himatika, conducting olimpiad mentoring 4. Mentoring on PkM proposal writing. 5. Seeking potential students on each class					
11	The average number of community service conducted by lecturers	0,83	1,04	1,46	1,67	1,88	2,08
	Strategies	1. Improving collaboration with other institutions outside UGM. 2. Improving service to mathematics user community					

		3. Conducting community service independently funded or through some grants from Department of Mathematics, FMNS, Ministry of Research Technology and High Education or other funding					
12	The average number of research by lecturers	0,83	0,92	1,00	1,08	1,17	1,21
	Strategies	1. Encouraging lecturers to do research independently or in a group 2. Encouraging lecturers to propose some research grants offered by Department of Mathematics or FMNS or Ministry of Research Technology and Higher Education or other funding sources					
13	Participation on Scientific Forum						
	Percentage Lecturer that are Member of Some Scientific Organization (<i>IndoMS</i> , Kamindo, KPA, <i>IndoMS</i> , dll)	100%	100%	100%	100%	100%	100%
	Percentage of Lecturer that are member of International Scientific Organization	5%	10%	15%	20%	25%	30%
	The average number of participation on Conference workshop, Seminar in one year	1,4	1,5	1,6	1,75	1,9	2,0
	Strategies	1. Encouraging lecturers to become member of national professional organization <i>IndoMS</i> , of particular suitable subject mathematics organization 2. Encouraging lecturers to attend seminars, <i>workshops</i> , and conferences, both national or international 3. Through the Department of Mathematics giving financial support to attend scientific forums					
14	Jumlah Publikasi per tahun (Perbandingan jml publikasi terhadap dosen)						
	National	0,25	0,25	0,25	0,25	0,25	0,25
	International	0,67	0,83	1	1,17	1,33	1,5
	Strategies	1. Encouraging lecturers to publish their research results on some mathematics journals 2. Encouraging lecturers to attend seminars, both national level or international level by giving financial support 3. Through the Department of Mathematics, giving incentive for scientific publications					
15	Internasional / Regional accreditation	<i>AUN</i>	<i>Pre ASIIN</i>	<i>Pre ASIIN</i>	<i>ASIIN</i>	<i>ASIIN</i>	<i>ASIIN</i>
	Strategies	1. Preparing facilities and supporting facilities for teaching learning in English 2. Proposing international accreditation (<i>ASIIN</i>). 3. Implementation of quality practice through Internal Quality Audit KJM UGM. 4. Collaboration with some universities, domestic and foreign, to improve quality of the programme					

1.1.7 Upgrading Curriculum 2016 Considerations

By taking the SWOT (Strength, Weakness, Opportunity, and Threat) into account, UP-Math continuously upgrades curriculum by improving RAISE (Relevance, Academic atmosphere, Internal management and organization, Sustainability, Efficiency and productivity).

Furthermore, based on Programme Educational Objective and Programme Learning Outcomes, UP-Math upgraded Curriculum 2016, which is a competency-based curriculum. The curriculum upgrading was done by considering:

1. Guidelines of Higher Education Curriculum and Assessment of Learning Outcomes (Minister of National Education No. 232 / U / 2000).
2. Regulation of the Minister of Research, Technology and Higher Education of the Republic of Indonesia No. 44 of 2015 about National Standard of Higher Education.
3. Minister of Education and Culture of the Republic of Indonesia: Regulation of the Minister of Education and Culture of the Republic of Indonesia No.73/2013 about Indonesian Qualifications Framework.
4. Government Regulation no. 19/2005, Decree of Minister of National Education No. 045/2002 about core curriculum of Higher Education and Decree of Rector of UGM No. 581 / P / SK / HT / 2010 concerning guidances of curriculum development 2016 for undergraduate level.
5. Results of FMNS UGM Senate meeting at the faculty level about common courses, i.e., Basic of Mathematics and Natural Science Courses, which include Calculus I, Basic Chemistry I, Basic Physics I, and Programming I in Semester I with 3 credits each.
6. Foresighting of science development of FMNS UGM 2016.
7. Alumni Feedback, Users, and Students in compulsory and elective courses along with the learning process.

1.1.8 Profession/Graduate Employment

Considering the universality of mathematics, profession/graduate employment quite diversifies. Based on alumni trace, it was known that they work in the field of education (teacher and lecturer), research (researches), government agency (ministries), banking (BNI, BRI, Mandiri, etc.), Actuary, IT (Packet System, IBM , Jati Solution, Gameloft, etc.), company (ASTRA, ELNUSA, IPCO-International in coal mining, etc.), BMKG, BPPS, and several companies abroad.

1.1.9 Graduate Profile

In general, the Graduate Profile of UP-Math is expected to work as:

1. Academics.
2. Assistant Researcher
3. Consultant
4. Practitioners (Industry, Service, Government).

1.1.10 Programme Learning Outcome (PLO)

Based on UP-Math's programme objectives, it is formulated nine (9) Programme Learning Outcome (PLO), which is done by considering:

1. Document "**Undergraduate Programs and Courses in the Mathematical Sciences:**

- CUPM Curriculum Guide 2004**” published by MAA
<http://www.maa.org/sites/default/files/pdf/CUPM/cupm2004.pdf>
2. Document “**CUPM Discussion Papers about Mathematics and the Mathematical Sciences in 2010: What Should Students Know?**” published by MAA
<http://www.maa.org/sites/default/files/pdf/CUPM/math-2010.pdf>
 3. Document “2015 CUPM Curriculum Guide to Majors in the Mathematical Sciences” published by MAA
 4. http://www.maa.org/sites/default/files/pdf/CUPM/pdf/CUPMguide_print.pdf
 5. Document “**The SIAM Report on Mathematics in Industry 2012**” published by SIAM
<http://www.siam.org/reports/mii/2012/report.php>
 6. Document “**Rekomendasi Capaian Pembelajaran serta Struktur Curriculum Minimal untuk Program S1 Matematika**” 2006 which was revised in September 2013 by The Indonesian Mathematical Society (IndoMS).
 7. SK Kepmendiknas No. 232/U/2000 and 045/U/2002 about curriculum and assessment at the university.
 8. Recommendations from alumni and stakeholders (users) through “**Policy Study**” (PHK A3 2005-2007).
 9. Direct networking through meetings or via email correspondence (2008 - 2016).
 10. Documented benchmarking results with
 - a. Mathematics Study Programme abroad: Nanyang Technological University (NTU), National Institute for Education (NIE), University of Graz (Uni. Graz), and University of Wollongong, Australia, University of Twente, The Netherland, and University of Waterloo, Amerika.
 - b. Mathematics Study Programme in the country: Universitas Indonesia (UI) Jakarta and Institut Teknologi Bandung (ITB) Bandung.
 - c. Results of visits to ASIIN Accreditation Board (<http://www.asiin-ev.de/pages/en/asiin-e.-v.php>) (Proyek WCRU 2009) and training ASIIN 25 - 27 May 2016.
 - d. Document AUN and General Criteria ASIIN.
 - e. Document BAN PT (<http://ban-pt.kemdiknas.go.id/>).

Programme Learning Outcomes/PLO of UP-Math have been formulated as follows.

PLO 1:	devote to God Almighty, Pancasila minded, and aware of the interest of the nation.
PLO 2:	are able to recognize mathematics-related problems, assess their solvability and solve them within a specified time frame.
PLO 3:	are able to develop their logic and mathematical thinking. They are in particular able to formulate mathematical hypotheses and have an understanding of how such hypotheses can be verified or falsified using mathematical methods.
PLO 4:	have sufficient knowledge in information technology and have ability it to support the teaching-learning and research process.
PLO 5:	have comprehensive knowledge in mathematical modelling and able to create mathematical models, both in mathematics, in other fields, and in real problems. They are in particular able to solve and determine the strategy how to solve the problems.
PLO 6:	have generalization and abstraction abilities and are able to recognize analogies and basic patterns.

PLO 7:	are able to communicate in mathematical language, oral and writing, concisely, clearly, and well-organized.
PLO 8:	have responsibility, confidence, emotional mature, ethics, and lifelong learner principle.
PLO 9:	have ability to apply their mathematics ability in their carrier related to mathematics and to continue their programme in master and doctoral programme.

PLO Mapping and Bloom's Taxonomy

Mapping of PLO for the suitability achievements of Skill, Competence, and Analysis in Bloom's Taxonomy is presented in the following table.

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9
Knowledge		v	v	v	v				
Skill		v		v	v	v	v		v
Competence	v	v	v		v	v		v	v

1.1.11 Study Materials

The consideration refers to the recommendations of IndoMS 2015 and the condition of UP-Math UGM. In running the curriculum, UP-Math FMNS UGM is supported by 4 (four) Laboratories (Research Groups) in the Department of Mathematics and other Laboratories outside the Department of Mathematics, including the Departments, and Faculties at UGM, and the other related universities.

Four Laboratories in Mathematics Department of FMNS UGM are:

1. **Laboratory of Analysis** which is responsible for the courses content of Calculus, Introduction to Real Analysis, Complex Variable Functions, and Geometry as well as the related elective courses.
2. **Laboratory of Algebra** which is responsible for the courses content of Mathematical Logic, Linear Algebra, Introduction to Abstract Algebra, and Discrete Mathematics as well as the related elective courses.
3. **Laboratory of Applied Mathematics** which is responsible for courses content of Mathematical Model, Differential Equation (Elementary Differential Equation, Partial Differential Equation, Introduction Problem of Boundary Requirement, System Theory, Control Theory, Dynamic System, etc.), and Optimization (Linear Programming, Operation Research , Theory of Optimization), along with the courses of related elective courses.
4. **Laboratory of Computational Mathematics** which is responsible for Computational Mathematics courses, including Numerical Analysis and Computational Differential Equation, Optimization, and Algebra. Convergence Algorithm Analysis, Error Estimation. The obtained algorithm is implemented in the programme on the laboratory work.

Whereas, the Laboratory in the Department of Mathematics, the Department in the FMNS outside the Department of Mathematics, the Faculties at UGM, and the universities that support UP-Math are:

- a. **Laboratory of Statistics**, Department of Mathematics, FMNS UGM.
- b. Department of Computer Science and Electronics Instrumentation, Department of Physics and Chemistry Department.
- c. Other related faculties / Universities.

Basic Capabilities and study materials

No.	Basic capabilities	Study materials
1	Basic Mathematics	Set Relation and Function Logic Proving Method System of Natural, Integer, and Rational Numbers
2	Differential Calculus and Integral	System of Real Numbers Function Limit Continuity Derivative Integral Sequence Series Vector-valued functions Two or more variables functions Partial derivative Double and triple integrals
3	Ordinary Differential Equations	Ordinary differential equations
4	Elementary Linear Algebra	Sistem of linear equations Matrices Vector space Linear transformations Orthogonalizations Eigen value and eigen vector Diagonalization and decomposition Quadratic form
5	Basic Optimizations	Linear Programming
6	Geometry	Field and space geometry
7	Basic Statistics	Data Descriptive statistics Measures of center and distribution Probability Distribution and probability Sampling distribution Introduction to hypothesis test Confidence interval

		Analysis of simple linear regression
8	Discrete Mathematics	Combination and Permutation
		Three fundamental principles
		Basic of graph theory
9	Basic computer and programming	Operation system
		Office
		Introduction to mathematics/statistics software (Matlab, SPSS, etc.)
		Basic programming
10	Basic of Mathematics and Natural Sciences	Calculus I
		Basic Physics I
		Basic Chemistry I
		Programming
11	Basic of ethics and general sciences	Religion
		Pancasila
		Civic
		Introduction to Philosophy of Sciences
		English
		Community Development Participation

Advance Capabilities

No.	Advance capabilities	Study materials
1	Partial Differential Equations	Theory and method of differential equations (Ordinary and partial differential equations)
		Special functions
		Boundary value problem
2	Numerical Analysis	Introduction to numerical analysis
		Computational mathematics
		Numerical linear algebra
3	Abstract Algebra	Group
		Ring
		Linear Algebra
4	Real Analysis	Theory of calculus, differential, and integral
5	Complex function	Analytic functions
		Integral
		Residue
6	Geometry	Generalization of geometry
7		Probability theory

No.	Advance capabilities	Study materials
	Probability theory and stochastic	Stochastic
8	Optimization	Operation research
		Non-linear optimization
		Network
9	Modelling	Mathematical modelling
10	Undergraduate Thesis	Undergraduate Thesis: Literature Study
		Undergraduate Thesis: Skripsi
11	Graph, Coding, and Cryptography	Graph
		Combinatorics
		Coding
		Cryptography
12	Dynamical system	Continuous dynamical system
		Discrete dynamical system
13	System and control theory	Introduction to game theory
		Introduction to system theory
		Introduction to control theory
14	Analysis Track	Introduction to functional analysis
		Introduction to topology
		Introduction to measure theory and Lebesgue integral
		Introduction to differential geometry
		Capita selecta analysis
15	Algebra Track	Introduction to semigroup
		Applied linear algebra I
		Applied linear algebra II
		Introduction to module theory
		Capita selecta algebra
16	Applied Track Mathematics	Capita selecta applied mathematics
17	Computational Track Mathematics	Capita selecta computational mathematics
18	Statistical Inference	Explorative data analysis
		Applied regression analysis
		Sample survey method
19	Actuary	Basic Micro Economy
		Basic Macro Economy
		Introduction to Statistical Theory
		Introduction to financial mathematics
20	Statistics for Government	Statistics for Government

5. Table of Linkage between compulsory and elective courses with study materials

No.	Basic capabilities	Courses to reach study materials	Courses Status
1	Basic Mathematics	Introduction to Mathematical Logic	Compulsory
		Set Theory	Compulsory
2	Calculus Diferensial and Integral	Calculus I	
		Calculus II	Compulsory
		Multivariable Calculus I	Compulsory
		Multivariable Calculus II	Compulsory
		Advanced Calculus	Compulsory
		Vector Analysis	Elective
3	Ordinary Differential Equations	Ordinary Differential Equations	Compulsory
4	Elementary Linear Algebra	Elementary Linear Algebra	Compulsory
		Numerical Linear Algebra	Elective
5	Basic Optimization	Linear Programming	Compulsory
6	Geometry	Geometry Analytic	Compulsory
		Geometry Transformations	Compulsory
7	Basic Statistics	Statistical Method I	Compulsory
		Statistical Method II	Elective
8	Discrete Mathematics	Discrete Mathematics I	Compulsory
		Discrete Mathematics II	Compulsory
9	Basic computer and programming	Programming I	
		Programming I Laboratory	Compulsory
		Programming I	Elective
		Programming I Laboratory	Elective
10	Basic of Mathematics and Natural Sicences	Calculus I	Compulsory
		Basic Physics I	Compulsory
		Basic Chemistry I	Compulsory
		Programming	Compulsory
11	Basic of ethics and general sciences	Religion	Compulsory
		Pancasila	Compulsory
		Civic	Compulsory
		Introduction to Philosophy of Sciences	Compulsory
		English	Compulsory
		Community Development Participation	Compulsory
		Entrepreneurship	Elective
		Internship	Elective

No.	Advance capabilities	Courses to reach study materials	Courses Status
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No.	Basic capabilities	Courses to reach study materials	Courses Status
1	Partial Differential Equations	Introduction to Partial Differential Equations	Compulsory
		Introduction to Theory of Differential Equation	Elective
		Introduction to Boundary Value Problem	Elective
2	Numerical Analysis	Introduction to Numerical Analysis	Compulsory
		Computational Mathematics	Compulsory
		Numerical Linear Algebra	Elective
3	Abstract Algebra	Introduction to Abstract Algebra I	Compulsory
		Introduction to Abstract Algebra II	Compulsory
		Linear Algebra	Compulsory
		Finite Group Theory	Elective
4	Real Analysis	Introduction to Analysis I	Compulsory
		Introduction to Analysis II	Compulsory
5	Complex function	Function of Complex Variables I	Compulsory
		Function of Complex Variables II	Compulsory
6	Geometry	Geometry	Elective
		Geometry in n -dimensional Euclidean Space in n -dimensional space	Elective
		Introduction to Fractal Geometry	Elective
7	Probability theory and stochastic	Introduction to Probability Theory	Compulsory
		Stochastic	Compulsory
8	Optimization	Operation Research	Elective
		Introduction to Optimization	Elective
9	Modelling	Introduction to Mathematical Modelling	Compulsory
		Biological Mathematics	Elective
10	Undergraduate Thesis	Undergraduate Thesis : Literature Study	Compulsory
		Undergraduate Thesis : Skripsi	Compulsory
11	Graph, Coding, and Cryptography Cryptographhy	Introduction to Graph Theory	Elective
		Introduction to Combinatorics	Elective
		Introduction to Coding Theory	Elective
		Introduction to Cryptography Theory	Elective

No.	Basic capabilities	Courses to reach study materials	Courses Status
No.	Advanced capabilities	Courses to reach study materials	Courses Status
12	Dynamical System	Dynamical System	Elective
		Introduction to Ergodic Theory	Elective
13	System and control theory	Introduction to Game Theory	Elective
		Introduction to System Theory	Elective
		Introduction to Control Theory	Elective
14	Analysis Track	Introduction to Functional Analysis	Elective
		Introduction to Topology	Elective
		Introduction to Theory of Measure and Lebesgue Integral	Elective
		Introduction to Differential Geometry	Elective
		Capita Selecta in Analysis	Elective
15	Algebra Track	Introduction to Semigroup	Elective
		Applied Linear Algebra II	Elective
		Applied Linear Algebra II	Elective
		Introduction of Module Theory	Elective
		Capita Selecta in Algebra	Elective
16	Applied Track Mathematics	Capita Selecta in Applied Mathematics A	Elective
		Capita Selecta in Applied Mathematics B	Elective
17	Computational Track Mathematics	Capita Selecta in Computational Mathematics	Elective
18	Statistical Inference	Explorative Data Analysis	Elective
		Applied Regression Analysis	Elective
		Sample Survey Method	Elective
		Quality of Statistics Controlling	Elective
19	Actuary	Introduction to financial mathematics I	Elective
		Introduction to Actuarial Accounting I	Elective
		Introduction to Statistical Mathematics I	Elective
		Introduction to Micro Economy	Elective
		Introduction to financial mathematics II	Elective
		Introduction to Macro Economy	Elective
		Introduction to Statistical Mathematics II	Elective

No.	Basic capabilities	Courses to reach study materials	Courses Status
		Introduction to Actuarial Accounting II	Elective
		Introduction to time series	Elective
		Introduction to Actuarial Mathematics I	Elective
		Introduction to Theory of Actuarial Risk I	Elective
		Introduction to Theory of Actuarial Risk II	Elective
		Analysis Data Survival	Elective
		Introduction to Actuarial Mathematics II	Elective
20	Statistics for Government	Statistics for Government	Elective

The structures of the UP-Math curriculum are as follows

Course Group	Course Name
University level Courses (11 Credits)	Compulsory courses: Religion (2 Credits), Pancasila (2 Credits), Civic (2 Credits), Introduction to Philosophy of Sciences (2 Credits), Community Development Participation (3 Credits).
Faculty level Courses (12 Credits)	Compulsory courses: Calculus I (3 Credits), Basic Physics I (3 Credits), Basic Chemistry I (3 Credits), Programming I (3 Credits).
Department level Courses (5 Credits)	Compulsory courses: English (2 Credits) and Introduction to Stochastic Process (3 Credits).
Generic Study Programme level Courses (76 Credits)	Compulsory courses that are not University and Faculty courses, including Undergraduate Thesis (6 Credits) and courses in the field: <ul style="list-style-type: none"> • Analysis (24 Credits: Calculus, Geometry, Complex Function, and Introduction to Analysis); • Algebra (Introduction to Mathematical Logic, Set Theory, Discrete Mathematics, Elementary Linear Algebra, Introduction to Abstract Algebra, and Linear Algebra); • Applied Mathematics (12 Credits: Ordinary and Partial Differential Equations, Linear Programming, Introduction to Mathematical Modelling);

	<ul style="list-style-type: none"> • Computational Mathematics (7 Credits: Laboratory Work of Programming 1, Introduction to Numerical Analysis, Computational Mathematics), and • Statistics (6 Credits: Statistical Method 1, Introduction to Probability Theory).
Non-generic Study Programme level Courses (Minimal 40 Credits)	Elective Courses: Students choose elective courses based on their interest. There are four tracks: Analysis, Algebra, Applied Mathematics, and Computational Mathematics.

1.1.12 List of Compulsory Courses

In the Curriculum 2016, some courses are accompanied by laboratory work. It is different with the Curriculum 2011, where we merge the theory and laboratory work credits. The Curriculum 2016 of UP-Math is divided into 2 (two) Groups of Courses, i.e.:

- Compulsory Courses with 104 credits in total and
- Elective Courses that are weighted at least 40 Credits that can be selected from the available elective courses at UP-Math or other study programmes/ Departmental/ Faculty/Universities.

The Curriculum 2016 is completed by some courses that are used in the Certification of Equality with the Association of Indonesia Actuaries (PAI: Persatuan Aktuaris Indonesia). Name of those courses are marked by code ♦.

Below are given some descriptions of the symbol and abbreviations in the list of courses.

- For prerequisite courses

Symbol	Meaning
*	has been taken and taken the final exam
**	can be taken simultaneously
without *	at least get grade D

- Every course completed by laboratory work is marked by course credit (1). For instance, course of Linear Programming 3 (1) means the course weighs 3 Credits and completed by laboratory work.
- For elective courses

Symbol	Meaning
♥	directed courses of applied mathematics track
♦	courses for sertification of equality with PAI

LIST OF COMPULSORY COURSES

Sem.	Nr.	Code	Course	Credits	Prerequisite	Remark	PIC
I:	1	MMM-1101	Calculus I	3			Department of Mathematics
	2	MFF-1011	Basic Physics I	3			Department of Physics
	3	MKK-1101	Basic Chemistry I	3			Department of Chemistry

	4	MII-1201	Programming I	3			Department of Computer science and Electronics
	5	MII-1202	Programming I Laboratory	1			Department of Computer science and Electronics
	6	MMM-1208	Introduction to Mathematical Logic	3			Lab. of Algebra
	7	UNU-100x	Religion	2		UNU-1000 Islam UNU-1001 Katolik UNU-1002 Kristen UNU-1003 Hindu UNU-1004 Budha UNU-1005 Konghucu	University
	8	MMS-1404	Statistical Methods I	3 (1)		with laboratory work	UP-Stat
Maximum Total Credits				21			
II	1	MMM-1102	Calculus II	3	MMM-1101*		Lab. of Analysis
	2	MMM-1106	Analytical Geometry	3	MMM-1101*		Lab. of Analysis
	3	MMM-1202	Elementary Linear Algebra	3			Lab. of Algebra
	4	MMM-1206	Discrete Mathematics I	2	MMM-1208*		Lab. of Algebra
	5	MMM-1203	Introduction to Algebraic Structure I	3	MMM-1208*		Lab. of Algebra
	6	MMM-1204	Set Theory	2	MMM-1208*		Lab. of Algebra
	7	MMM-1001	English	2			Department of Mathematics
	8	UNU-1010	Pancasila	2			University
	9		Elective Course	3			
Maximum Total Credits				23			
III	1	MMM-2109	Multivariable Calculus I	2	MMM-1102* MMM-1106*		Lab. of Analysis
	2	MMM-2201	Introduction to Algebraic Structure II	3	MMS-1203*		Lab. of Algebra
	3	MMM-2301	Elementary Differential Equations	3	MMM-1102*		Lab. of Applied Mathematics
	4	MMS-2410	Introduction Probability Models	3	MMM-1102*		Lab. of Statistics

	5	MMM-2207	Discrete Mathematics II	2	MMM-1206*		Lab. of Algebra
	6	MMM-2114	Transformation Geometry	2	MMM-1106*		Lab. of Analysis
	7	MMM-2312	Linear Programming	3 (1)	MMM-1202*	with laboratory work	Lab. of Applied Mathematics and Lab of Mathematical Computation
	8		Elective Courses (maximum)	6			
Maximum Total Credits				24			
IV	1	MMM-2110	Multivariable Calculus II	2	MMM-2109* (PS S1 Matematika), MMS-2428* (PS S1 Statistika)		Lab. of Analysis
	2	MMM-2111	Advanced Calculus	2	MMM-1102*		Lab. of Analysis
	3	MMM-2112	Function of Complex Variables I	2	MMM-2109*		Lab. of Analysis
	4	MMM-2202	Linear Algebra	3	MMM-1202* MMM-2201*		Lab. of Algebra
	5	MMM-2401	Introduction to Numerical Analysis	3 (1)	MMM-2301*	with laboratory work	Lab of Mathematical Computation
	6	MMM-2310	Introduction to Partial Differential Equations	3	MMM-2109* MMM-2301*		Lab. of Applied Mathematics
	7		Elective Courses (maximum)	9			
Maximum Total Credits				24			
V	1	MMM-3101	Introduction to Analysis I	3	MMM-2111*		Lab. of Analysis
	2	MMM-3401	Computational Mathematics	3 (1)	MMM-2310* MMM-2401*	with laboratory work	Lab of Mathematical Computation
	3	MMM-3106	Function of Complex Variables II	2	MMM-2112*		Lab. of Analysis
	4	MMM-3303	Introduction to Mathematical Models	3	MMM-2310** MMS-2410*		Lab. of Applied Mathematics
	5	MMM-3002	Introduction to Stochastic Process	3	MMS-2410*		Department of Mathematics
	6	MMM-3001	Introduction to Philosophy of Sciences	2	≥ 80 Credits		University (Faculty of Philosophy)
	7		Elective Courses (maximum)	8			
Maximum Total Credits				24			
VI	1	MMM-3102	Introduction to Analysis II	3	MMM-3101*		Lab. of Analysis
	2	UNU-3000	Civic	2	≥ 60 Credits		University

	3	UNU-4500	Community Development Participation (the implementation is in semester break)	3	≥100 Credits		University
	4		Elective Courses (maximum)	16			
Maximum Total Credits				24			
VII	1	MMM-4097	Undergraduate Thesis : Literature Study	3	≥120 Credits, IPK ≥ 2.0, without grade E, percentage of total credit with grade D less than or equal 25%.		UP-Math
			Elective Courses	9			
Maximum Total Credits				12			
VIII	2	MMM-4098	Undergraduate Thesis : Skripsi	6	Studi Literatur**		UP-Math
Maximum Total Credits				6			

List of Elective Courses

Elective Courses "Study Programme "							
No.	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	V	MMM-3003	Entrepreneurship	2	≥80 Credits		UP-Math
2	VI/ VII/ VIII	MMM-4001	Internship	3	≥100 Credits, IPK ≥ 3.00, without grade E, percentage of total credit with grade D less than or equal 25%.		UP-Math
Elective Courses "Analysis and Geometry"							
No.	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	II	MMM-1105	Introduction to Number Theory	3	MMM-1208*		Lab. of Analysis
2	III	MMM-2113	Geometry	3	MMM-1106* MMM-1208*		Lab. of Analysis
3	III	MMM-2115	Geometry in n-dimensional Euclidean Space in n-dimensional Space	3	MMM-1106*		Lab. of Analysis
4	IV	MMM-2105	Vector Analysis	2	MMM-2109*		Lab. of Analysis
5	VI	MMM-3108	Introduction to Topology	3	MMM-3102**		Lab. of Analysis
6	VI	MMM-3103	Introduction to Theory of Differential Equation	3	MMM-3102**		Lab. of Analysis

7	VI	MMM-3105	Introduction to Theory of Measure and Lebesgue Integral	3	MMM-3102**		Lab. of Analysis
8	VI	MMM-3107	Introduction to Differential Geometry	3	MMM-2109*		Lab. of Analysis
9	VII	MMM-4102	Introduction to Functional Analysis	3	MMM-3102*		Lab. of Analysis
10	VII/ VIII	MMM-4149	Capita Selecta in Analysis	3	MMM-3101		Lab. of Analysis

Elective Courses "Algebra and Discrete Mathematics"

No	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	III	MMM-2210	Applied Linear Algebra I	2	MMM-1202*		Lab. of Algebra
2	III	MMM-2208	Finite Group Theory	2	MMM-1203*		Lab. of Algebra
3	IV	MMM-2209	Introduction to Combinatorics	3	MMM-2207*		Lab. of Algebra
4	IV	MMM-2206	Introduction to Graph Theory	3	MMM-2207*		Lab. of Algebra
5	V	MMM-3206	Introduction to Coding Theory	3	MMM-2202*		Lab. of Algebra
6	VI	MMM-3210	Introduction to Semigroup Theory	3	MMM-1203*		Lab. of Algebra
7	VI	MMM-3209	Applied Linear Algebra II	2	MMM-2202*		Lab. of Algebra
8	VII	MMM-4207	Introduction of Module Theory	3	MMM-2202*		Lab. of Algebra
9	VII	MMM-4206	Introduction to Cryptography	3	MMM-2202*		Lab. of Algebra
10	VII/ VIII	MMM-4249	Capita Selecta in Algebra	3	MMM-2202*		Lab. of Algebra

Elective Courses "Applied Mathematics"

No	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	III	MMM-2308	Introduction to Game Theory	3			Lab. of Applied Mathematics
2	IV	MMM-2303	Biological Mathematics	3	MMM-2301*, MMS-2410*		Lab. of Applied Mathematics
3	V	MMM-3310	Introduction to Theory of System♥	3	MMM-2202*, MMM-2301*		Lab. of Applied Mathematics
4	V	MMM-3311	Introduction to Boundary Value Problem	3	MMM-2310*		Lab. of Applied Mathematics
5	VI	MMM-3306	Dynamical System♥	3	MMM-1202*, MMM-2301*		Lab. of Applied Mathematics
6	VI	MMM-3312	Introduction to Control Theory	3	MMM-3310*		Lab. of Applied Mathematics
7	VII	MMM-4303	Introduction to Ergodic Theory	3	MMM-3306*		Lab. of Applied Mathematics
8	VII/ VIII	MMM-4349A	Capita Selecta in Applied Mathematics A	3	MMM-3303*		Lab. of Applied Mathematics
9	VII/ VIII	MMM-4349B	Capita Selecta in Applied Mathematics B	3	MMM-3303*		Lab. of Applied Mathematics

Elective Courses "Mathematical Computation"							
No	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	VI	MMM-4449	Capita Selecta in Computational Mathematics	3	MMM-3401*		Lab of Mathematical Computation
2	VII	MMM-4401	Introduction to Fractal Geometry	3	MMM-2112*		Lab of Mathematical Computation
Elective Courses "Algebra and Mathematical Computation"							
No	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	V	MMM-3208	Numerical Linear Algebra	3 (1)	MMM-2202*	with laboratory work	Lab. of Algebra and Lab of Mathematical Computation
Elective Courses "Applied Mathematics and Mathematical Computation"							
No	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	IV	MMM-2311	Operation Research	3 (1)	MMM-2312*	with laboratory work	Lab. of Applied Mathematics and Lab of Mathematical Computation
2	VI	MMM-3309	Introduction to Theory of Optimization♥	3 (1)	MMM-2312*	with laboratory work	Lab. of Applied Mathematics and Lab of Mathematical Computation
Elective Courses "Statistics"							
No	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	II	MMS-1410	Explorative data analysis	3 (1)	MMS-1404*	with laboratory work	UP-Stat
2	II	MMS-1409	Statistical Method II	3(1)	MMS-1404*	with laboratory work	UP-Stat
3	III	MMS-2481	Survey sample method	2	MMS-1404*		UP-Stat
4	III	MMS-2418	Introduction to financial mathematics I♦	3	MMM-1102*		UP-Stat
5	III	MMS-2492	Introduction to Actuarial Accounting I♦	3		PAI	UP-Stat
6	III	MMS-2421	Applied Regression analysis♦	3 (1)	MMS-1409*	PAI with laboratory work	UP-Stat
7	III	MMS-2420	Introduction to Statistical Mathematics I♦	3	MMM-1102*	PAI	UP-Stat

8	III	MMS-2493	Introduction to Micro Economy ♦	3		PAI	UP-Stat
9	IV	MMS-2419	Introduction to financial mathematics II ♦	3	MMS-2418*	PAI	UP-Stat
10	IV	MMS-2497	Introduction to Macro Economy ♦	3	MMS-2493*	PAI	UP-Stat
11	IV	MMS-2483	Introduction to Statistical Mathematics II ♦	3	MMS-2420*	PAI	UP-Stat
12	IV	MMS-2425	Statistical Quality Control	3 (1)	MMS-1404*	with laboratory work	UP-Stat
13	IV	MMS-2496	Introduction to Actuarial Accounting II ♦	3	MMS-2492*	PAI	UP-Stat
14	V	MMS-3429	Introduction to time series ♦	3 (1)	MMS-2420*	PAI with laboratory work	UP-Stat
15	V	MMS-3438	Introduction to Actuarial Mathematics I ♦	3 (1)	MMS-2418*	PAI with laboratory work	UP-Stat
16	V	MMS-3432	Introduction to Theory of Actuarial Risk I ♦	3		PAI	UP-Stat
17	VI	MMS-3434	Introduction to Theory of Actuarial Risk II ♦	3	MMS-3432*	PAI	UP-Stat
18	VI	MMS-3443	Survival Data Analysis ♦	3 (1)	MMS-1409*	PAI with laboratory work	UP-Stat
19	VI	MMS-3477	Introduction to Actuarial Mathematics II ♦	3	MMS-3438*	PAI	UP-Stat
20	VI	MMS-3488	Official Statistics	2			UP-Stat
Elective Courses "Computer science"							
No	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	II	MII-1211	Programming II	3	MII-1201*		UP-CS
2	II	MII-1212	Programming II Laboratory	1	MII-1202* MII-1211**		UP-CS

1.1.13 General Regulations and Transitional Rules

1. General Regulations

- a. Compulsory courses in Semester I and Semester II are the packages that must be taken by all first year students
- b. Students who have GPA on Semester I more than 3.00 are allowed to take additional elective courses until the total maximum Credits in Semester II is 23 Credits.
- c. The elective courses outside the list of courses in the Curriculum 2016 UP-Math can be taken by the students with maximum total of 9 Credits. Nevertheless, out of those 9 Credits, it is not allowed for the students to take the courses with equivalent contents, such as Entrepreneurship in UP-Math and Entrepreneurship in other study programmes, etc.
- d. Students who are going to take or taking Undergraduate Thesis with topic in Applied Mathematics are required to take at least one directed elective course of Applied

Mathematics (marked by ♥) that fits to the topic of the Undergraduate Thesis : Dynamical System, Introduction to Optimization Theory, and Introduction to System Theory. The minimum grades of those courses are C.

- e. The location of internship is determined and found by students with the direction from the study programme management. Internship will be supervised by the advisory team. Credits of internship must be registered to the KRS Semester VI or VII or VIII. Guidance of taking internship is provided in a separate document.

2. Graduation Requirements (Study Burden)

To complete undergraduate education in UP-Math, students are required to complete at least 144 Credits of courses containing (96 to 106 Credits, including the Undergraduate Thesis and Community Development Participation) and elective courses. Requirements of graduation follow the rules of the FMNS UGM.

3. Rules and Grades of Retaking Courses

Students have a right to improve their CGPA by retaking the courses to meet the minimum graduation requirements or to achieve a certain CGPA.

- a. Students who enroll the Undergraduate Thesis : Literature Study of the academic year 2018/2019 and thereafter, the Undergraduate Thesis is the last course. The exam of the Undergraduate Thesis is the last semester for them.
- b. Students who enroll the Undergraduate Thesis : Literature Study of the academic year 2017/2018, retaking of courses may be done at most one semester after the exam of the Undergraduate Thesis .
- c. Students who enroll the Undergraduate Thesis : Literature Study of the academic year 2016/2017 and earlier, retaking of courses may be done at most one year after the exam of the Undergraduate Thesis .
- d. Grade of a retaking course is the best one among all grades of that course.
- e. At the time of the judicium, the status of the courses Set Theory, Introduction to Mathematical Statistics I, and Stochastic Process follow the semester of the courses taken with the best grade proposed.

4. Compulsory Courses

Compulsory courses must be taken by every student. In addition, to take a course, it is required certain requirements (prerequisite, corequisite or other requirements). Therefore, students are expected to pay attention to this matter.

5. Elective Courses

- a. Elective courses consist of directed elective courses and free elective courses.
- b. By default, students are free to choose the available elective courses each semester. However, in order to have an adequate ability, the students have to consider and fulfill the required requirements (prerequisite, corequisite or other requirements) as well as consult and consider the advice from their Academic Advisors when choosing elective courses.
- c. For some reason, the elective courses may change its position from Semester II to Semester I and vice versa. Free elective courses may be inactive/not available for a while.

- d. Beside the available elective courses, students can take the other available courses at the Study Programme at the FMNS by considering the prerequisites of the courses.

If a credit transfer system between faculties or universities is available, students may take elective courses from other Faculties/Universities, by consulting with their Academic Advisors.

The number of maximum Credits of elective courses that are allowed from outside UP-Math that are not listed in the Curriculum 2016 UP-Math FMNS UGM is 9 Credits. It has to follow the related study programme rules of the courses taken, has to be approved by the Academic Advisors, and gets permit from the study programme that organizes the taken course. For courses from outside the FMNS, permission is made between faculties.

6. Undergraduate Thesis

a. Undergraduate Thesis Format

The Undergraduate Thesis of students in the form of undergraduate Thesis has a weight of 9 Credits and must be taken by every student of UP-Math. Undergraduate Thesis aims to:

- i. sharpen the ability of thinking critically, logically and analytically.
- ii. practice the ability to write scientific papers comprehensively
- iii. practice independence in developing a scientific career.
- iv. prepare to continue studying, going to the community, or the employment.
- v. practice the ability to argue scientifically.
- vi. practice communication skills and interpersonal relationship.

b. Supervisor of Undergraduate Thesis : The number of supervisor of final project is maximum 2 people.

c. Requirements of taking Undergraduate Thesis

d. Students who will take the Undergraduate Thesis have to fulfill the following requirements:

- i. The CGPA of all courses taken has been greater than or equal to 2.00.
- ii. Have taken at least 120 Credits (without grade E and percentage of credits with grade D is at most 25%).
- iii. Have taken/are taking courses supporting the topic of the Undergraduate Thesis .
- iv. Include Undergraduate Thesis in KRS and register it to the Secretariat of UP-Math no later than one week after the KRS submission.

e. Undergraduate Thesis Implementation

In practice, the Undergraduate Thesis is supervised by one or two lecturers.

Undergraduate Thesis consists of Literature Study and Skripsi under the following conditions.

- i. Undergraduate Thesis : Literature Study can be done by students independently or in a group.
- ii. At the end of the Undergraduate Thesis : Literature Study, students are required to attend additional lecture (no weight of Credits) about the method of writing Final Taks from UP-Math.
- iii. Undergraduate Thesis : Skripsi is done by students independently.

- iv. Topic of the Undergraduate Thesis : Literature Study and Skripsi must be the same. If the topic of Undergraduate Thesis changes, the students must repeat the Undergraduate Thesis : Literature Study even though they have passed the Undergraduate Thesis : Literature Study with the previous topic.
 - v. The supervisor of Undergraduate Thesis : Literature Study is also for Undergraduate Thesis : Skripsi. If required, students/supervisors may propose an additional supervisor for Undergraduate Thesis : Skripsi.
 - vi. Undergraduate Thesis : Literature Study and Undergraduate Thesis : Skripsi can be in one semester. If they are taken at different semesters, it must be taken in 2 (two) consecutive semesters. If within 2 (two) semesters the results obtained are not significant, the supervisor may propose to discontinue the supervision and vice versa the students may also apply for a replacement supervisor. In the event of a supervisor's replacement, the topic of the Undergraduate Thesis is from the new supervisor, not the topic from the former supervisor. Replacement of supervisor can only be done a maximum of 1 time.
 - vii. Students have to meet their supervisors at most a week after announcement of their supervisors. If the students do not meet their supervisors more than one week, the supervisors may refuse to them.
 - viii. If the students are not active in supervision when taking the Undergraduate Thesis Literature Study, the supervisors may propose to discontinue supervision at the final evaluation of the semester at the time of completing the assessment form.
- f. Undergraduate Thesis Assessment
- i. Undergraduate Thesis : Literature Study is assessed by supervisor.
 - ii. Undergraduate Thesis : Skripsi is assessed by a team of examiners consisting of four to five lecturers: supervisor(s), two lecturers from the same field and one lecturer from outside the field.

Outcome and responsibility

At the end of semester of Literature Study, students have to submit a report to the supervisor. And students who start their undergraduate thesis in Semester I 2018/2019, have to take seminar of undergraduate thesis literature study. The seminar assessed by the supervisor and is open for all UP-Math students.

Code	Course	Credit	Prerequisite	Outcome and Responsibility	Prerequisite of Seminar and or Defense	Examiner	Explanation
MMM 4091	Undergraduate Thesis I (UT I)	3	Students have collected at least 120 credits with GPA 2. Credits with grade D is at most 25%	1. Written Report 2. Seminar of UT I in front of supervisor and some other students	Written Report	Supervisor	UT I Report and Seminar of UT I should be completed: 1. at the end of semester

MMM-4092	Undergraduate Thesis II (UT II)	6	1. UT I**	1. Written Report 2. Defense in front of examiner team (consists of supervisor(s), examiner from the corresponding laboratory and external examiner)	1. Written Report (UT II) 2. Has attended Studium General for UT, organized by the UP-Math 3. Has attended at least a seminar of UT I	Examiner team	of UT I , those who take 3 and 6 Credit UT in different semester 2. by two weeks before defense for those who take 9 credits at a time.
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7. Community Development Participation (KKN: Kuliah Kerja Nyata)

KKN may only be taken by students who have completed 100 Credits of courses with CGPA of ≥ 2.00 . In addition, when taking KKN in a regular semester, students are only allowed to take one of the following:

- a. Finishing of the Undergraduate Thesis .
- b. Taking one course.

8. Internship (KP: Kerja Praktek)

Requirements for Internship:

1. The student has collected at least 100 credits (final mark are issued and the total credits with final mark D is less than or equal to 25%).
2. GPA is at least 2.50.
3. Implementation Time: during semester VI/VII/VIII or semester break, for one to three months (excluded report writing).
4. Place : students are supposed to decide.
5. The internship should be included on Study Card of the corresponding semester (VI/VII/VIII), done after the place for the internship is definite. For internship taken during the semester break, students should follow these rules:
 - i. If an internship is taken during semester break between Semester V and Semester VI, the internship should be included in Study Card of Semester VI.
 - ii. If an internship is taken during semester break between Semester VI and Semester VII, the internship should be included in Study Card of Semester VII.
 - iii. If an internship is taken during semester break between Semester VII and Semester VIII, the internship should be included in Study Card of Semester VIII.

Standard Operational Procedure (SOP) and Completeness of Internship:

1. Students contact the destination company for internship.
2. After students get company's agreement, The UP Math will assign a supervisor(s).
3. Students take and do filling form provided at The UP-Math Secretariat.
4. Students bring the filled form to the Secretariat of The Up-Math and then to The Department Secretariat to be signed.
5. The signed form is submitted to the Faculty (Second Floor of Faculty Building).
6. The student waits for the permit letter issued (typically in a few days).
7. Student brings the permit letter to the destination company.
8. The student does the internship and prepares a report under supervision of the supervisor.
9. The student asks for assessment from the supervision and the company.
10. Student submits the report to the UP-Math Secretariat (hardcopy and softcopy in CD, and acknowledgment page as well), to the Faculty Library (hardcopy and softcopy in CD), and to the company.

1.1.14 Implementation and Transitional Rules For Students Batch 2015 or Before

The Curriculum 2016 of UP-Math FMNS UGM is enacted from the first semester of academic year 2016/2017.

Particularly, in the academic year 2016/2017, the courses of Introduction to Partial Differential Equations is specifically held in each semester.

Specially, in Semester I of the academic year 2016/2017, the course of Introductory to Partial Differential Equations and Computational Mathematics c can be taken simultaneously.

Students of batch 2015 and earlier follow the transitional rules as follows.

1. Students of batch 2015 and earlier are not required to take Basic Chemistry I and Set Theory.
2. Students of batch 2015 and earlier are not required to take courses in the Curriculum 2016 that are equivalent to the compulsory courses in the Curriculum 2011 that they have taken. See Equivalence Section.
3. Students of batch 2014 and earlier who have not passed the course of Introduction to Philosophy of Science, History, and Mathematical Ethics must take courses Introduction to Philosophy of Science.
4. In the absence of the common faculty courses 2011: Contextual Mathematics, Physical Concept, Contextual Chemistry, and Contemporary Information Technology, students of batch 2015 and earlier whose obtained a maximum of grade B may remove those courses. Specifically, this removal is not taken into account in the removal of the maximum 10% courses in the FMNS rules.
5. Students of batch 2015 or earlier may be graduated if they have completed at least 144 Credits, consisting of 96 to 106 Credits of compulsory courses and 38 to 46 Credits of elective courses.
6. In the following table, there are several possibilities that can be selected by the students who have passed the courses listed on the

table. If the course marked W is chosen as a compulsory course, then the course marked P may be chosen as an elective course.

Description of Symbols

- L : have passed
 TL : have not passed
 WA : must be taken
 TWA : may not be taken

No.	Curriculum 2011			Curriculum 2016	
1	Discrete Mathematics (3 Credits)		=	Discrete Mathematics I (2 Credits)	Discrete Mathematics II (2 Credits)
	TL			WA	WA
	Specially, in Semester I of the academic year 2016/2017: for students who have taken Discrete Mathematics in semester II of the academic year 2015/2016 or earlier and have not passed, Discrete Mathematics becomes to be the prerequisite of taking Discrete Mathematics II.				
2	Algorithm and Data Structure I (3 Credits)	Laboratory Work of Algorithm and Data Structure I (1 Credits)	=	Programming I (3 Credits)	Laboratory Work of Programming I (1 Credits)
	L	TL		TWA	WA
	TL	L		WA	TWA
	TL	TL		WA	WA
3	Mechanics A (2 Credits)			Basic Physics I (3 Credits)	
	TL			WA	

1.1.15 Equivalence of the Curriculum 2011 to the Curriculum 2016

Compulsory and Elective Courses in "Analysis and Geometry" Track

No	Curriculum 2011				Curriculum 2016		
	Code	Course	Credits		Code	Course	Credits
1	MMM-1103	Geometry Analytic A	3	=	MMM-1106	Geometry Analytic	3
2	MMM-3104	Topology	3	=	MMM-3108	Introduction to Topology	3
3					MMM-3107	Introduction to Differential Geometry	3

No	Curriculum 2006				Curriculum 2016		
	Code	Course	Credits		Code	Course	Credits
1	MMS-3105	Geometry in n-dimensional Space	3	=	MMM-2115	Geometry in n-dimensional Euclidean Space in n-dimensional Space	3

Compulsory and Elective Courses in “Algebra and Discrete Mathematics” Track

No.	Curriculum 2011				Curriculum 2016		
	Code	Course	Cred its		Code	Course	Cred its
1	MMM-1201	Introduction to Mathematical Logic and Set	3	=	MMM-1208	Introduction to Mathematical Logic	3
2	MMM-1205	Discrete Mathematics	3	=	MMM-1206	Discrete Mathematics I	2
					MMM-2207	Discrete Mathematics II	2
3	MMM-2204	Applied Linear Algebra	2	=	MMM-2210	Applied Linear Algebra I	2
4	MMM-3205	Teori Semigrup	3	=	MMM-3210	Introduction to Semigroup	3
5	MMM-3203	Teori Grup Hingga	2	=	MMM-2208	Teori Grup Hingga	2
6	MMM-3204	Numerical Linear Algebra	2	=	MMM-3208	Numerical Linear Algebra	3
7	MMM-3254	Laboratory Work of Numerical Linear Algebra	1				
8				=	MMM-3209	Applied Linear Algebra II	3
9	MMM-3207	Module Theory	3	=	MMM-4207	Introduction to Module Theory	3
10				=	MMM-4206	Introduction to Cryptographhy	3
11	MMM-4204	Introduction to Combinatorics	3	=	MMM-2209	Introduction to Combinatorics	3

Compulsory and Elective Courses in “Applied Mathematics” and “Computational Mathematics” Tracks

No.	Curriculum 2011				Curriculum 2016		
	Code	Course	Credits		Code	Course	Credits
1	MMM-2302	Linear Programming	2	=	MMM-2312	Linear Programming	3
2	MMM-2352	Laboratory Work of Linear Programming	1				
3	MMM-2306	Introduction to Numerical Analysis	2	=	MMM-2401	Introduction to Numerical Analysis	3
4	MMM-2356	Laboratory Work of Introduction to Numerical Analysis	1				
5	MMM-3302	Introduction to Partial Differential Equations	3	=	MMM-2310	Introduction to Partial Differential Equations	3
6	MMM-2307	Operation Research	2	=	MMM-2311	Operation Research	3
7	MMM-2357	Laboratory Work of Operation Research	1				
8	MMM-3304	Optimization Theory	2	=	MMM-3309	Introduction to Optimization Theory	3
9	MMM-3354	Laboratory Work of Optimization Theory	1				
10	MMM-3301	System Theory	3	=	MMM-3310	Introduction to System Theory	3
11	MMM-4304	Discrete Dynamical System	3	=	MMM-4303	Introduction to Ergodic Theory	3
12	MMM-3307	Boundary Value Problem	3	=	MMM-3311	Introduction to Boundary Value Problem	3
13	MMM-3308	Control Theory	3	=	MMM-3312	Introduction to Control Theory	3
14	MMM-2306	Introduction to Numerical Analysis	2	=	MMM-2401	Introduction to Numerical Analysis	3
15	MMM-2356	Laboratory Work of Introduction to Numerical Analysis	1				
16					MMM-3002	Introduction to Stochastic Process	3
17					MMM-4401	Introduction to Fractal Geometry	3
18					MMM-4449	Capita Selecta in Computational Mathematics	3

Compulsory and Elective Courses in "Statistics" Track

No.	Curriculum 2011				Curriculum 2016		
	Code	Course	Credits		Code	Course	Credits
1	MMS-1423	Statistical Method I	2	=	MMS-1404	Statistical Method I	3
2	MMS-1453	Laboratory Work of Statistical Method I	1				
3	MMS-1425	Statistical Method II	2	=	MMS-1409	Statistical Method II	3(1)
4	MMS-1455	Laboratory Work of Statistical Method II	1				
5	MMS-2411	Introduction to Mathematical Statistics I	3	=	MMS-2420	Introduction to Mathematical Statistics I	3
6	MMS-3469	Introduction to Mathematical Statistics II	3	=	MMS-2483	Introduction to Mathematical Statistics II	3
7	MMS-1406	Explorative Data Analysis	2	=	MMS-1410	Explorative Data Analysis	3 (1)
8	MMS-1456	Laboratory Work of Explorative Data Analysis	1				
9	MMS-2403	Sample Survey Method	3	=	MMS-2481	Sample Survey Method	2
10	MMS-3427	Research Metodology	3	=	MMS-3488	Official Statistics	2
11					MMS-2418	Introduction to Financial Mathematics I♦	3
12					MMS-2419	Introduction to Financial Mathematics II♦	3
13					MMS-2492	Introduction to Actuarial Accountancy I♦	3
14					MMS-2496	Introduction to Actuarial Accountancy II♦	3
15	MMS-2423	Statistical Quality Controlling	2	=	MMS-2425	Statistical Quality Controlling	3 (1)
16	MMS-2453	Laboratory Work of Statistical Quality Controlling	1				
17	MMS-3402	Applied Regression Analysis	2	=	MMS-2421	Applied Regression Analysis♦	3 (1)
18	MMS-3452	Laboratory Work of Applied Regression Analysis	1				
19	MMS-3472	Introduction to Actuarial Mathematics I	2	=	MMS-3438	Introduction to Actuarial Mathematics I♦	3 (1)
20	MMS-3492	Laboratory Work of Introduction to Actuarial Mathematics I	1				
21	MMS-3473	Analysis Data Survival	2	=	MMS-3443	Analysis Data Survival♦ di A 50 Analysis Data	3 (1)
22	MMS-3493	Laboratory Work of Analysis Data Survival	1				
23	MMS-3402	Applied Regression Analysis	2	=	MMS-2421		3(1)

24	MMS-3452	Applied Regression Analysis	1			Applied Regression Analysis ♦	
25	MMS-3471	Introduction to Time Series	2	=	MMS-3429	Introduction to Time Series ♦	3 (1)
26	MMS-3451	Laboratory Work of Introduction to Time Series	1				
27	MMS-3417	Applied Analysis of Variance	2	=	MMS-2424	Applied Analysis of Variance	3 (1)
28	MMS 3457	Laboratory Work of Applied Analysis of Variance	1				
29					MMS-3432	Introduction to Theory of Actuarial Risk I	3
30					MMS-3434	Introduction to Theory of Actuarial Risk II	3
31					MMS-2493	Introduction to Micro Economy ♦	3
32					MMS-2497	Introduction to Macro Economy ♦	3

The equivalence of the Statistics courses which are not provided in the table, can be referred in the curriculum of the undergraduate programme of statistics of Department of Mathematics FMNS UGM (UP-Stat).

Compulsory and Elective Courses in "Computer Science" Track

No.	Curriculum 2011				Curriculum 2016		
	Code	Course	Credits		Code	Course	Credits
1					MII-1211	Programming II	3
2					MII-1212	Laboratory Work of Programming II	1

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No.	Curriculum 2011				Curriculum 2016		
	Code	Course	Credits		Code	Course	Credits
1	UMM-1001	English	2	=	MMM-1001	English	2
2	UNU-2010	Pancasila	2	=	UNU-1010	Pancasila	2
3	UNU-1000	Religion	2	=	UNU-100x	Religion	2
4	UMM-3001	Introduction to Philosophy of Sciences, History, and Mathematical Ethics	3	=	MMM-3001	Introduction to Philosophy of Sciences	2
5	MIB-1000	Contemporary Information Technology	2				
6	MIK-1251	Algorithm and Data Structure I	3	=	MII-1201	Programming I	3

7	MIK-1252	Laboratory Work of Algorithm and Data Structure I	1	=	MII-1202	Laboratory Work of Programming I	1
8	MFB-1000	Physical Concept	2				
9	MKB-1000	Contextual Chemistry	2				
10					MKK-1101	Basic Chemistry 1	3
11	MMM-1118	Mechanics A	2	=	MFF-1011	Basic Physics I	3
12	MMB-1000	Contextual Mathematics	2				

Equivalence of Courses outside the list of the Curriculum 2016 of UP-Math that are not regulated here follows equivalence rules at study programme where the courses are held.

Cooperation UGM with PAI (Persatuan Aktuaris Indonesia)

Some courses that held by UP-Stat can be used to obtain certification of PAI exam subjects up to ASAI level (Associate of Society of Actuaries of Indonesia). Equivalence of PAI exam subjects held by UP-Stat is provided in the following table.

PAI exam subject	Matakuliah PS Statistika UGM
A.10. Financial Mathematics	Introduction to Financial Mathematics I
	Introduction to Financial Mathematics II
A.20. Probability and Mathematical Statistics	Introduction to Mathematical Statistics I
	Introduction to Mathematical Statistics II
A.30. Accountancy	Introduction to Actuarial Accountancy I
	Introduction to Actuarial Accountancy II
A.40. Economics	Introduction to Micro Economics
	Introduction to Macro Economics
A.50. Statistical Methods	Applied Regression Analysis
	Survival Data Analysis
	Introduction to Time Series
A.60. Actuarial Mathematics	Introduction to Actuarial Mathematics I
	Introduction to Actuarial Mathematics II
A.70. Modelling and Risk Theory	Introduction to Theory of Actuarial Risk I
	Introduction to Theory of Actuarial Risk II

The process for submitting PAI certification is done collectively through the Administration of the Department of Mathematics FMNS UGM. Further information on this cooperation can be obtained at the Department of Mathematics FMNS UGM. Requirements of grade equivalence are:

For one PAI exam subject which is equivalent to two UGM courses, grades must be A and A/B or both A.

For one PAI exam subject which is equivalent to three UGM courses, grades must be two A\Bs and A or A\B and two As, or three As.

1.1.16 Learning and Assessment Methods

In the learning process, the lecturers at UP-Math are expected to apply the Student Centered Learning (SCL) method. The most appropriate SCL method to be applied to several courses in UP-Math is Collaborative Learning (CbL), Problem-Based Learning (PBL) or combination of both. However, if the SCL method is supposed to be unsuitable, UP-Math does not force to use it in the learning process.

Teaching Methods: Lectures, Discussions, Programmed Instruction, Study Assignment, Tutorials, Seminars, Demonstrations, Buzz Group, Brainstorming, Role Play.

No.	Programme Learning Outcome (PLO)	Courses and Teaching Methods	Assessment Methods
1	devote to God Almighty, Pancasila minded, and aware of the interest of the nation.	Religion (S): Lectures; Discussions, presentation	<i>Locally developed exam;</i> Direct Observation
		Pancasila (M): Lectures; Discussions, presentation	<i>Locally developed exam;</i> Direct Observation
		Civic (L): Lectures; Discussions	Direct Observation, <i>Locally developed exam;</i>
		Introduction to Filsafat Ilmu: Lectures; Discussions	Direct Observation, <i>Locally developed exam;</i>
2	are able to recognize mathematics-related problems, assess their solvability and solve them within a specified time frame	All courses and the courses mentioned at Point 1.: Lectures, Discussions, <i>Study Assignment</i>	Class Activity (Homeworks, reports), Presentation, <i>Capstone Project</i> , Tasks, Performance, Direct Observation, <i>Locally developed exam.</i>
3	are able to develop their logic and mathematical thinking. They are in particular able to formulate mathematical hypotheses and have an understanding of how such hypotheses can be verified or falsified using mathematical methods	Calculus I: Lectures, Discussions, <i>Study Assignment</i>	Class Activity (Homeworks, reports), Presentation, <i>Capstone Project</i> , Tasks, Performance, Direct Observation, <i>Locally developed exam.</i>
		Introduction to Mathematical Logic: Lectures, Discussions, <i>Study Assignment</i>	Class Activity (Homeworks, reports), Presentation, <i>Capstone Project</i> , Tasks, Performance, Direct Observation, <i>Locally developed exam.</i>
		Elementary Linear Algebra: Lectures, Discussions, <i>Study Assignment</i>	Class Activity (Homeworks, reports), Presentation, <i>Capstone Project</i> , Tasks, Performance, Direct Observation, <i>Locally developed exam.</i>
		Statistical Method I: Lectures, Discussions, <i>Study Assignment</i>	
		Calculus II: Lectures, Discussions, <i>Study Assignment</i>	
		Discrete Mathematics I: Lectures, Discussions, <i>Study Assignment</i>	
Introduction to Abstract Algebra I: Lectures, Discussions, <i>Study Assignment</i>			

No.	Programme Learning Outcome (PLO)	Courses and Teaching Methods	Assessment Methods
		Linear Programming: Lectures, Discussions, Study Assignment	
		Multivariable Calculus I: Lectures, Discussions, Study Assignment	
		Introduction to Abstract Algebra II: Lectures, Discussions, Study Assignment	
		Discrete Mathematics II: Lectures, Discussions, Study Assignment	
		Geometry Transformation: Lectures, Discussions, Study Assignment	
		Multivariable Calculus II: Lectures, Discussions, Study Assignment	
		Advance Calculus : Lectures, Discussions, Study Assignment	
		Complex Variable Function I: Lectures, Discussions, Study Assignment	
		Linear Algebra: Lectures, Discussions, Study Assignment	
		Introduction to Numerical Analysis: Lectures, Discussions, Study Assignment	
		Introduction to Analysis I: Lectures, Discussions, Study Assignment	
		Computational Mathematics: Lectures, Discussions, Study Assignment	
		Introduction to Stochastic Process: Lectures, Discussions, Study Assignment	
		Introduction to Mathematical Modelling : Lectures, Discussions, Study Assignment	

No.	Programme Learning Outcome (PLO)	Courses and Teaching Methods	Assessment Methods
		Introduction to Analysis II: Lectures, Discussions, <i>Study Assignment</i>	
		Undergraduate Thesis : Literature Study	
		Undergraduate Thesis : Skripsi	
4	have sufficient knowledge in information technology and have ability it to support the teaching-learning and research process	Basic Physics I: Lectures, Discussions, <i>Study Assignment</i>	<i>Locally developed exam</i>
		Basic Chemistry I: Lectures, Discussions, <i>Study Assignment</i>	<i>Locally developed exam; Class Activity (Homeworks, reports).</i>
		Programming I: Lectures, Discussions, <i>Study Assignment</i>	<i>Locally developed exam; Class Activity (Homeworks, reports).</i>
		Statistical Method I: Lectures, Discussions, <i>Study Assignment</i>	Simulation; <i>Focus group; Class assignment; Tasks, Performance;</i>
		Linear Programming: Lectures, Discussions, <i>Study Assignment</i>	<i>Locally developed exam; Class Activity (Homeworks, reports).</i>
		Introduction to Numerical Analysis: Lectures, Discussions, <i>Study Assignment</i>	Tasks, Performance; Ujian Standard <i>Locally developed exam; Interview</i>
		Computational Mathematics: Lectures, Discussions, <i>Study Assignment</i>	
5	have comprehensive knowledge in mathematical modelling and able to create mathematical models, both in mathematics, in other fields, and in real problems. They are in particular able to solve and determine the strategy how to solve the problems	Introduction to Stochastic Process: (M) Lectures, Discussions, <i>Study Assignment, Buzz Group.</i>	<i>Locally developed exam; Class Activity, Presentation</i>
		Undergraduate Thesis : Literature Study: (S) Discussions, <i>Study Assignment, Brainstorming.</i>	Direct Observation, Presentation, Tasks, Performance
		Undergraduate Thesis : Skripsi (S): Discussions, <i>Study Assignment, Brainstorming.</i>	Theses papers.
		KKN: (M): Discussions, <i>Study Assignment, Brainstorming, Demonstration</i>	Tasks, Performance; Direct Observation <i>Locally developed exam; Interview</i>

No.	Programme Learning Outcome (PLO)	Courses and Teaching Methods	Assessment Methods
6	have generalization and abstraction abilities and are able to recognize analogies and basic patterns	Programming I: Lectures, Discussions, <i>Study Assignment</i> Laboratory Work of Programming I: Lectures, Discussions, <i>Study Assignment</i> Basic Physics I: Lectures, Discussions, <i>Study Assignment</i> English: Lectures, Discussions, <i>Study Assignment</i> Multivariable Calculus I: Lectures, Discussions, <i>Study Assignment</i> Ordinary Differential Equations: Lectures, Discussions, <i>Study Assignment</i> Multivariable Calculus II; Lectures, Discussions, <i>Study Assignment</i> Advance Calculus : Lectures, Discussions, <i>Study Assignment</i> Complex Variable Function I: Lectures, Discussions, <i>Study Assignment</i> Introduction to Numerical Analysis: Lectures, Discussions, <i>Study Assignment</i> Computational Mathematics: Lectures, Discussions, <i>Study Assignment</i>	<i>Locally developed exam; Class Activity (Homeworks, reports).</i> <i>Locally developed exam; Class Activity (Homeworks, reports).</i> <i>Locally developed exam; Class Activity (Homeworks, reports).</i>
7	are able to communicate in mathematical language, oral and writing, concisely, clearly, and well-organized	English: Lectures, Discussions, <i>Study Assignment</i> Undergraduate Thesis : Literature Study Undergraduate Thesis : Skripsi	 Theses papers. exam; Class Activity, Presentation Theses papers.
8	have responsibility, confidence, emotional	All courses, in particular Pancasila, Civic, Introduction to Philosophy of Sciences,	Class Activity (Homeworks, reports), Presentation, <i>Capstone</i>

No.	Programme Learning Outcome (PLO)	Courses and Teaching Methods	Assessment Methods
	mature, ethics, and lifelong learner principle	Undergraduate Thesis : Lectures, Discussions, <i>Study Assignment</i> , <i>Buzz Group</i> .	<i>Project</i> , <i>Tasks</i> , <i>Performance</i> , <i>Direct Observation</i> , <i>Ujian Standard</i> , <i>Locally developed exam</i> , <i>Simulation</i> ,
9	have ability to apply their mathematics ability in their carrier related to mathematics and to continue their programme in master and doctoral programme	Basic Physics I: Lectures, Discussions, <i>Study Assignment</i> Basic Chemistry I: Lectures, Discussions, <i>Study Assignment</i> Programming I: Lectures, Discussions, <i>Study Assignment</i> Statistical Method I: Lectures, Discussions, <i>Study Assignment</i> Calculus II: Lectures, Discussions, <i>Study Assignment</i> Geometriy Analytic : Lectures, Discussions, <i>Study Assignment</i> English: Lectures, Discussions, <i>Study Assignment</i> Ordinary Differential Equations: Lectures, Discussions, <i>Study Assignment</i> Introduction to Numerical Analysis: Lectures, Discussions, <i>Study Assignment</i> Introduction to Pers. Diferensial Parsial: Lectures, Discussions, <i>Study Assignment</i> Introduction to Analysis I: Lectures, Discussions, <i>Study Assignment</i> Computational Mathematics: Lectures, Discussions, <i>Study Assignment</i>	<i>Locally developed exam</i> ; Class Activity (Homeworks, reports). <i>Locally developed exam</i> ; Class Activity (Homeworks, reports). <i>Locally developed exam</i> ; Class Activity (Homeworks, reports). Class Activity (Homeworks, reports); Studi Kasus; <i>Focus group</i> Presentation, <i>Capstone Project</i> , <i>Tasks</i> , <i>Performance</i> , <i>Direct Observation</i> , <i>Locally developed exam</i> , <i>Simulation</i>)

No.	Programme Learning Outcome (PLO)	Courses and Teaching Methods	Assessment Methods
		Complex Variable Function II: Lectures, Discussions, <i>Study Assignment</i> Introduction to Mathematical Modelling : Lectures, Discussions, <i>Study Assignment</i> Introduction to Stochastic Process: Lectures, Discussions, <i>Study Assignment</i> Introduction to Analysis II: Lectures, Discussions, <i>Study Assignment</i> Civic: Lectures, Discussions, <i>Study Assignment</i> Undergraduate Thesis : Literature Study: Discussions, <i>Study Assignment</i> Undergraduate Thesis : Skripsi : Discussions, <i>Study Assignment</i>	

In the evaluation of the PLO for the courses in UP-Math the following conditions are applied.

3. The assessment components include Tasks (independent or group, Homeworks), Quiz, Mid Exam (UTS: Ujian Tengah Semester) and Final Exam (UAS: Ujian Akhir Semester). At the first meeting, the lectures announce the assessment components and their percentages.
4. If the student does not take the final exam of a course, the grade must be given (can not be empty). The grade is not automatically E, depending on the percentage of the assessment components given at the beginning of the lecture.
5. In principle, UTS can be held more than once. If the UTS of a course is conducted more than once, then its schedule beyond the faculty schedule is determined by the lecturer of the course.
6. For courses with parallel classes, questions in the UTS and UAS should be the same for all classes.

Assessment Methods: Class Activity (paper, presentation, report), Capstone Project, Tasks, Performance, Direct Observation, Portfolio, External Examiner, Standard Exam, Locally developed exam, Certification and licensure exams, Simulations, Theses/Senior papers, Surveys: Student surveys, alumni surveys, user surveys, national surveys, interviews, Focus groups, case studies.

Students who have TOEFL grade not less than 450 are not required to follow the English course. However, students must include English course in KRS and to obtain English grade, students are required to submit photocopy of TOEFL certificates Lecturer who is appointed to teach English. The certificate must be submitted at least one day before mid exam. Conversion of TOEFL grade to Mathematical English grade is:

TOEFL grade	Mathematical English grade
450 - 499	B
500 atau lebih	A

The recognized Language Institute are UGM Language Institute or minimum is equivalent, i.e., ELTI, EF, and LIA.

Specifically, for Undergraduate Thesis, the assessment is regulated as follows.

1. Undergraduate Thesis : Literature Study
 - a. Assessment is done by supervisors at the end of the semester.
 - b. Assessment is based on mastery of the material and the supervision process (activeness, enthusiasm, seriousness, and fighting spirit).
2. Undergraduate Thesis : Skripsi
 - a. Undergraduate Thesis : Skripsi exam is done after the Undergraduate Thesis : Literature Study has been announced.
 - b. Undergraduate Thesis : Skripsi examiner is the supervisor(s) and three lecturers (2 lecturers from the laboratory which is suitable with the topic of the Undergraduate Thesis and 1 lecturer from another field/laboratory).
 - c. Assessment is based on manuscript (material, methodology, scientific writing, and language) and presentation (mastery of material and performance).
 - d. The Undergraduate Thesis : Skripsi exam is regulated in the Manual Procedure of Undergraduate Thesis exam of UP-Math.
 - e. **Time limit of revision is 2 months** after Undergraduate Thesis exam. If until the deadline, the revision has not been completed, then the student must repeat the Undergraduate Thesis exam.
 - f. Minimal grade to pass the Undergraduate Thesis : Literature Study and Skripsi is C.