UNIVERSITAS ISLAM NEGERI MAULANA MALIK IBRAHIM MALANG
Faculty of Science and Technology
Mathematics Study Program
Jl. Gajayana No. 50 Malang 65144 Telp. / Fax. (0341) 558933, website : www.matematika.uin-malang.ac.id, e-mail : matematika@uin-malang.ac.id

Mathematics Study Program

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Website : www.matematika.uin-malang.ac.id

MODULE HANDBOOK

Module name	Aljabar Linier Elementer *Elementary Linear Algebra*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060111D06
Courses, if applicable	Aljabar Linier Elementer *Elementary Linear Algebra*
Semester(s) in which the module is taught	2nd
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Prof. Dr. Turmudi, M.Si Dewi Ismiarti, M.Si Intan Nisfulaila, M.Si Dedy Zulkarnaen Purnamaadi, M.Si
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah wajib *Compulsory course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Aljabar Linier Elementer sekurang-kurangnya 80% dari pertemuan. *The students have attended the Elementary Linear Algebra course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	-
Module objectives/intended learning outcomes	Mahasiswa mampu CO 1. menyelesaikan dan menganalisis sistem linier CO 2. mendemonstrasikan berbagai operasi matriks CO 3. menghitung dot product, cross product, dan menentukan keortogonalan vektor-vektor CO 4. menjelaskan konsep ruang vektor riil, subruang, basis, dimensi CO 5. menentukan nilai dan vektor eigen

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<table>
<tr><td></td><td>CO 6. mendemonstrasikan metode Gram-Schmidt untuk memperoleh basis ortogonal

The students are able to:
CO 1. Solve and analyze linear systems.
CO 2. Demonstrate various matrix operations.
CO 3. Compute dot products, cross products, and determining vector orthogonality.
CO 4. Articulate the concepts of real vector space, subspace, basis, and dimension.
CO 5. Determine eigenvalues and eigenvectors.
CO 6. Demonstrate the Gram-Schmidt method for obtaining orthogonal bases.</td></tr>
<tr><td>Content</td><td>Mata kuliah ini membahas mengenai sistem linier, ruang vektor, subruang vektor, kombinasi linier, kebebaslinieran, basis, dimensi, ruang baris dan ruang kolom, rank suatu matriks dan aplikasinya dalam pencarian basis, ruang hasil kali dalam, panjang dan jarak vektor, basis orthogonal dan basis orthonormal, proses Gram-Schmidt, koordinat dan perubahan basis, transformasi linier dan sifat-sifatnya, kernel, matriks transformasi linier, nilai eigen dan vektor eigen, keserupaan.

This course covers topics including linear systems, vector spaces, vector subspaces, linear combinations, linear independence, basis, dimension, row space and column space, matrix rank and its application in finding bases, inner product spaces, vector length and distance, orthogonal bases and orthonormal bases, the Gram-Schmidt process, coordinates and basis transformations, linear transformations and their properties, kernels, linear transformation matrices, eigenvalues and eigenvectors, and similarity.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
The final grade will be weighted as follows:
<table>
<tr><th>No.</th><th>Metode Penilaian
Assessment Methods</th><th>Bobot
Weight</th></tr>
<tr><td>1</td><td>Tugas
Assignment</td><td>20%</td></tr>
<tr><td>2</td><td>Kuis
Quiz</td><td>20%</td></tr>
<tr><td>3</td><td>UTS
Midterm Examination</td><td>30%</td></tr>
<tr><td>4</td><td>UAS
Final Examination</td><td>30%</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>1. Anton, H., & Rorres, C. (2013). Elementary linear algebra: applications version. John Wiley & Sons.
2. Andrilli, S., & Hecker, D. (2022). Elementary linear algebra. Academic Press.</td></tr>
</table>

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PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CO 1							✓				
CO 2				✓							
CO 3				✓							
CO 4			✓				✓				
CO 5				✓						✓	
CO 6			✓				✓			✓	

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MODULE HANDBOOK

Module name	Logika dan Himpunan *Logic and Set*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060111D03
Courses, if applicable	Logika dan Himpunan *Logic and Set*
Semester(s) in which the module is taught	1st
Person responsible for the module	Ketua konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Mohammad Nafie Jauhari, M.Si Evawati Alisah, M.Pd Dedy Zulkharnain Purnamaadi, M.Si
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah wajib *Compulsory course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Logika dan Himpunan sekurang-kurangnya 80% dari pertemuan. *The students have attended the Logic and Set course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	-
Module objectives/intended learning outcomes	Mahasiswa mampu CO 1. menyatakan masalah di dunia nyata ke dalam bentuk proposisi disertai operator logika dan kuantor CO 2. membuktikan nilai kebenaran proposisi menggunakan tabel kebenaran dan aturan logika CO 3. menerapkan metode pembuktian langsung dan tidak langsung untuk membuktikan pernyataan matematika sederhana

<table>
<tr><td></td><td>CO 4. membuktikan pernyataan dan ekuivalensi himpunan yang disertai operasi himpunan
CO 5. membuktikan sifat-sifat dan jenis dari relasi dan fungsi

The students are able to:
CO 1. Formulate real-world problems into propositions accompanied by logical operators and quantifiers.
CO 2. Prove the truth values of propositions using truth tables and logical rules.
CO 3. Apply direct and indirect proof methods to prove simple mathematical statements.
CO 4. Prove statements and equivalences of sets accompanied by set operations.
CO 5. Prove the properties and types of relations and functions.</td></tr>
<tr><td>Content</td><td>Mata kuliah ini membahas mengenai konsep dasar kalimat pernyataan yang memuat berbagai operator logika (negasi, konjungsi, disjungsi, implikasi, dan biimplikasi) dan kuantor (universal dan eksistensial) beserta cara menentukan nilai kebenarannya, aturan inferensi, metode pembuktian langsung dan pembuktian tidak langsung (kontradiksi dan kontraposisi), himpunan dan operasinya, relasi, serta fungsi dan jenisnya.

This course covers fundamental concepts of statement sentences containing various logical operators (negation, conjunction, disjunction, implication, and biconditional) and quantifiers (universal and existential), along with determining their truth values, inference rules, direct proof methods, and indirect proof methods (contradiction and contrapositive). Additionally, it encompasses sets and their operations, relations, as well as functions and their types.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
The final grade will be weighted as follows:
<table>
<tr><td>No.</td><td>Metode Penilaian
Assessment Methods</td><td>Bobot
Weight</td></tr>
<tr><td>1</td><td>Tugas
Assignment</td><td>20%</td></tr>
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<tr><td>4</td><td>UAS
Final Examination</td><td>30%</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>1. Rosen, K. H. (2012). Discrete mathematics and its applications.
2. Devlin, K. (2018). Sets, functions, and logic: an introduction to abstract mathematics. Chapman and Hall/CRC.
3. Rodgers, N. (2000). Learning to reason: an introduction to logic, sets, and relations. John Wiley & Sons.</td></tr>
</table>

4. *Mendelson, E. (2015).* Introduction to mathematical logic. Textbooks in Mathematics.
5. *Morash, R. P. (1991).* Bridge to abstract mathematics: Mathematical Proof and Structures. *McGraw-Hill College.*

PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CO 1			✓								
CO 2				✓							
CO 3				✓						✓	
CO 4				✓			✓				
CO 5				✓			✓			✓	

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MODULE HANDBOOK

Module name	Matematika Diskrit *Discrete Mathematics*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060111D08
Courses, if applicable	Matematika Diskrit *Discrete Mathematics*
Semester(s) in which the module is taught	2nd
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Juhari, M.Si Muhammad Khudzaifah, M.Si Mohammad Nafie Jauhari, M.Si
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah wajib *Compulsory course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Matematika Diskrit sekurang-kurangnya 80% dari pertemuan. *The students have attended the Discrete Mathematics course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	-
Module objectives/intended learning outcomes	Mahasiswa mampu CO 1. menggunakan kaidah pencacahan, permutasi, dan kombinasi dalam menyelesaikan persoalan matematika yang terkait CO 2. menggunakan relasi rekurensi untuk menyelesaikan masalah yang terkait CO 3. menentukan fungsi pembangkit dari suatu CO 4. mengidentifikasi jenis dan sifat suatu graf serta terapannya

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	The students are able to: *CO 1. Apply principles of counting, permutations, and combinations to solve related mathematical problems.* *CO 2. Utilize recurrence relations to address relevant problems.* *CO 3. Determine generating functions for a given purpose.* *CO 4. Identify the types and characteristics of a graph, as well as its applications.*
Content	Mata kuliah ini membahas prinsip-prinsip prosedur/algoritma tentang dasar-dasar kaidah pencacahan, permutasi, kombinasi, relasi rekurensi, fungsi pembangkit, graf serta penerapannya dalam berbagai bidang. *This course discusses the principles of procedures/algorithms concerning the fundamentals of counting principles, permutations, combinations, recurrence relations, generating functions, graphs, and their applications in various fields.*
Study and examination requirements and forms of examination	Nilai akhir akan diberi bobot sebagai berikut: *The final grade will be weighted as follows:*
Media employed	Whiteboard, Projector, Laptop
Reading List	Rosen, K. H. (2007). *Discrete mathematics and its applications*. The McGraw Hill Companies.

No.	Metode Penilaian *Assessment Methods*	Bobot *Weight*
1	Tugas *Assignment*	20%
2	Kuis *Quiz*	20%
3	UTS *Midterm Examination*	30%
4	UAS *Final Examination*	30%

PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CO 1			✓			✓	✓				
CO 2			✓				✓				
CO 3				✓							
CO 4		✓	✓			✓	✓				

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MODULE HANDBOOK

Module name	Pengantar Struktur Aljabar I *Introduction to Algebraic Structure I*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060111D15
Courses, if applicable	Pengantar Struktur Aljabar I *Introduction to Algebraic Structure I*
Semester(s) in which the module is taught	3rd
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Dewi Ismiarti, M.Si. Intan Nisfulaila, M.Si Dedy Zulkarnaen Purnamaadi, M.Si
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah wajib *Compulsory course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Pengantar Struktur Aljabar I sekurang-kurangnya 80% dari pertemuan. *The students have attended the Introduction to Algebraic Structure I course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	Logika dan Himpunan *Logic and Set*
Module objectives/intended learning outcomes	Mahasiswa mampu CO 1. menyusun tabel hasil operasi dari suatu himpunan dan menjelaskan sifat-sifat operasi yang berlaku CO 2. menjelaskan sifat-sifat dasar yang berlaku pada grup, grup siklis, grup simetri CO 3. membuktikan subgrup, kenormalan subgrup, serta sifat-sifat dasar pada grup dan subgrup

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<table>
<tr><td></td><td>CO 4. mendemonstrasikan Teorema Lagrange untuk menentukan orde atau membuktikan akibat yang berlaku pada grup
CO 5. membuktikan homomorfisma dan sifat-sifat dasar terkait homomorfisma grup
CO 6. menjelaskan konstruksi grup kuosien dan menentukan unsur-unsurnya

The students are able to:
CO 1. Construct tables of operations for a set and explain the properties of the operations.
CO 2. Explain the fundamental properties applicable to groups, cyclic groups, and symmetric groups.
CO 3. Prove subgroups, subgroup normality, and basic properties of groups and subgroups.
CO 4. Demonstrate Lagrange's Theorem to determine orders or prove consequences applicable to groups.
CO 5. Prove homomorphisms and basic properties related to group homomorphisms.
CO 6. Explain the construction of quotient groups and determine their elements.</td></tr>
<tr><td>Content</td><td>Mata kuliah ini bertujuan memperkenalkan struktur aljabar yang terdiri dari satu himpunan dilengkapi satu operasi, khususnya grup. Mahasiswa diharapkan mampu bekerja dengan struktur tersebut serta mengkomunikasikannya. Matakuliah ini membahas operasi biner, grup, subgrup, orde grup, pembangun grup, grup siklis, grup simetri, Teorema Cayley, koset, Teorema Lagrange, homomorfisma dan isomorfisma grup, subgrup normal, grup kuosien.

This course aims to introduce algebraic structures consisting of a set equipped with a single operation, particularly groups. Students are expected to work with these structures and communicate effectively about them. The course covers binary operations, groups, subgroups, group orders, group generators, cyclic groups, symmetric groups, Cayley's Theorem, cosets, Lagrange's Theorem, group homomorphisms and isomorphisms, normal subgroups, and quotient groups.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
The final grade will be weighted as follows:
<table>
<tr><th>No.</th><th>Metode Penilaian
Assessment Methods</th><th>Bobot
Weight</th></tr>
<tr><td>1</td><td>Tugas
Assignment</td><td>20%</td></tr>
<tr><td>2</td><td>Kuis
Quiz</td><td>20%</td></tr>
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Midterm Examination</td><td>30%</td></tr>
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</table></td></tr>
<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
</table>

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Reading List	1. Gilbert, L. (2014). *Elements of modern algebra*. Cengage Learning 2. Gallian, J. A. (2021). *Contemporary abstract algebra*. Chapman and Hall/CRC. 3. Fraleigh, J. B. (2003). *A first course in abstract algebra*. Pearson Education India. 4. Herstein, I. N. (1975). *Topics in algebra*. John Wiley & Sons.

PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CO 1			✓				✓				
CO 2			✓								
CO 3				✓							
CO 4							✓				
CO 5				✓							
CO 6			✓				✓			✓	

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MODULE HANDBOOK

Module name	Pengantar Struktur Aljabar II *Introduction to Algebraic Structure II*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060111D16
Courses, if applicable	Pengantar Struktur Aljabar I *Introduction to Algebraic Structure I*
Semester(s) in which the module is taught	4th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Dewi Ismiarti, M.Si. Intan Nisfulaila, M.Si Dedy Zulkarnaen Purnamaadi, M.Si
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah wajib *Compulsory course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Pengantar Struktur Aljabar II sekurang-kurangnya 80% dari pertemuan. *The students have attended the Introduction to Algebraic Structure II course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	Pengantar Struktur Aljabar I *Introduction to Algebraic Structure I*
Module objectives/intended learning outcomes	Mahasiswa mampu: CO 1. menjelaskan struktur dari suatu himpunan yang dilengkapi dua operasi merupakan gelanggang, subgelanggang, ideal, daerah integral, atau lapangan CO 2. menemukan unsur-unsur yang memenuhi sifat-sifat tertentu dari suatu gelanggang dan unsur-unsur dari gelanggang kuosien CO 3. membuktikan sifat-sifat dasar yang berlaku pada gelanggang atau unsur-unsurnya

<table>
<tr><td></td><td>CO 4. membuktikan homomorfisma dan sifat-sifat dasar terkait homomorfisma gelanggang
CO 5. mendemonstrasikan faktorisasi pada gelanggang polinomial
CO 6. mengembangkan konsep faktorisasi dari gelanggang polinomial ke daerah integral

The students are able to:
CO 1. Explain the structure of a set equipped with two operations, which constitutes a ring, subring, ideal, integral domain, or field.
CO 2. Identify elements satisfying specific properties of a ring and elements of quotient rings.
CO 3. Prove basic properties applicable to rings or their elements.
CO 4. Prove homomorphisms and basic properties related to ring homomorphisms.
CO 5. Demonstrate factorization in polynomial rings.
CO 6. Develop the concept of factorization from polynomial rings to integral domains.</td></tr>
<tr><td>Content</td><td>Mata kuliah ini bertujuan memperkenalkan struktur aljabar yang terdiri dari satu himpunan dilengkapi dua operasi, khususnya gelanggang. Mahasiswa diharapkan mampu bekerja dengan struktur tersebut serta mengkomunikasikannya. Mata kuliah ini membahas gelanggang, subgelanggang, ideal, gelanggang kuosien, daerah integral, lapangan, homomorfisma gelanggang, gelanggang polinomial, dan keterbagian di daerah integral, daerah ideal utama.

This course aims to introduce algebraic structures consisting of a set equipped with two operations, particularly rings. Students are expected to work with these structures and effectively communicate about them. The course covers rings, subrings, ideals, quotient rings, integral domains, fields, ring homomorphisms, polynomial rings, and divisibility in integral domains, as well as principal ideal domains.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
The final grade will be weighted as follows:
<table>
<tr><th>No.</th><th>Metode Penilaian
Assessment Methods</th><th>Bobot
Weight</th></tr>
<tr><td>1</td><td>Tugas
Assignment</td><td>20%</td></tr>
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<tr><td>4</td><td>UAS
Final Examination</td><td>30%</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>1. Gilbert, L. (2014). Elements of modern algebra. Cengage Learning
2. Gallian, J. A. (2021). Contemporary abstract algebra. Chapman and Hall/CRC.</td></tr>
</table>

	3. Fraleigh, J. B. (2003). *A first course in abstract algebra*. Pearson Education India. 4. Herstein, I. N. (1975). Topics in algebra. John Wiley & Sons.

PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CO 1			✓								
CO 2			✓	✓			✓				
CO 3			✓							✓	
CO 4			✓				✓				
CO 5				✓			✓				
CO 6				✓						✓	

Date of Last Amendment:
July 27th, 2023

UNIVERSITAS ISLAM NEGERI MAULANA MALIK IBRAHIM MALANG
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MODULE HANDBOOK

Module name	Kapita Selekta Aljabar *Selected Topics in Algebra*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060112E01
Courses, if applicable	Kapita Selekta Aljabar *Selected Topics in Algebra*
Semester(s) in which the module is taught	5th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Dewi Ismiarti, M.Si Mohammad Nafie Jauhari, M.Si
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan *Elective course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Kapita Selekta Aljabar sekurang-kurangnya 80% dari pertemuan. *The students have attended the Introduction to Algebraic Structure I course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	-
Module objectives/intended learning outcomes	Mahasiswa mampu CO 1. memahami dan mengidentifikasi konsep-konsep materi atau topik yang sedang berkembang dalam bidang aljabar CO 2. menganalisis teori dan aplikasi dari topik-topik baru dalam aljabar, baik dari segi teori maupun terapannya. CO 3. mengkaji kajian paper/makalah terkait dengan topik-topik yang dibahas dalam mata kuliah dan mengungkapkan pandangan kritis terhadapnya.

<table>
<tr><td></td><td>CO 4. menggunakan sumber daya digital dan teknologi dalam penelitian dan eksplorasi topik-topik baru dalam aljabar.
CO 5. menyusun dan menghasilkan paper sederhana yang mencerminkan pemahaman mereka terhadap topik yang telah dipelajari dalam mata kuliah dan mampu menyajikannya dengan jelas dan terstruktur.

The students are able to:
CO 1. Understand and identify evolving concepts and topics in the field of algebra.
CO 2. Analyze the theory and applications of new topics in algebra, both theoretically and practically.
CO 3. Evaluate papers or documents related to the topics covered in the course and express critical views on them.
CO 4. Utilize digital resources and technology in researching and exploring new topics in algebra.
CO 5. Compile and produce simple papers reflecting their understanding of the topics studied in the course and present them clearly and cohesively.</td></tr>
<tr><td>Content</td><td>Mata kuliah ini akan membahas wawasan mengenai materi/topik yang sedang berkembang dan sesuai dengan kebutuhan saat ini. Mata kuliah ini mengkaji topik-topik baru tentang aljabar, baik dari segi teori maupun terapannya. Kajian paper/makalah tentang topik tersebut disajikan dalam bentuk diskusi dan presentasi. Diharapkan muncul topik-topik tugas akhir.

This course will provide insights into emerging materials/topics that are relevant to current needs. It will examine new topics in algebra, encompassing both theoretical and practical aspects. Papers/articles on these topics will be presented through discussions and presentations. It is expected that topics for final projects will emerge from these discussions.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
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</table></td></tr>
<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>Recent Articles in the Field of Algebra</td></tr>
</table>

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PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CO 1	✓	✓		✓							
CO 2		✓	✓	✓			✓				
CO 3		✓		✓						✓	✓
CO 4	✓							✓	✓		
CO 5	✓	✓				✓	✓	✓	✓		✓

Date of Last Amendment:
August 27th, 2023

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MODULE HANDBOOK

Module name	Aljabar Komputer *Computer Algebra*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060112E10
Courses, if applicable	Aljabar Komputer *Computer Algebra*
Semester(s) in which the module is taught	6th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Dewi Ismiarti, M.Si.
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan *Elective course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Aljabar Komputer sekurang-kurangnya 80% dari pertemuan. *The students have attended the Computer Algebra course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	Pengantar Struktur Aljabar II *Introduction to Algebraic Structure II*
Module objectives/intended learning outcomes	Mahasiswa mampu: CO 1. mengurutkan suku-suku dari polinomial multivariabel CO 2. mendemonstrasikan algoritma pembagian pada gelanggang polinomial multivariabel CO 3. menjelaskan pengertian dan sifat-sifat dasar basis Gröbner CO 4. mendemonstrasikan algoritma Buchberger untuk mendapatkan basis Gröbner CO 5. mengimplementasikan aplikasi dasar dari basis Gröbner pada sistem aljabar komputer (Computer Algebra System)

<table>
<tr><td></td><td>The students are able to:
CO 1. Ordering terms of multivariable polynomials
CO 2. Demonstrate the division algorithm in multivariable polynomial rings.
CO 3. Explain the concept and basic properties of Gröbner bases.
CO 4. Demonstrate the Buchberger algorithm to obtain Gröbner bases.
CO 5. Implement basic applications of Gröbner bases using Singular-CAS or other software.</td></tr>
<tr><td>Content</td><td>Matakuliah ini bertujuan memperkenalkan teori basis Gröbner di gelanggang polinomial multivariabel atas lapangan. Materi matakuliah ini meliputi gelanggang polinomial multivariabel atas lapangan, ideal, teorema Basis Hilbert, term order, algoritma pembagian, basis Gröbner, basis Gröbner tereduksi, S-polinomial, algoritma Buchberger, aplikasi dasar basis Gröbner, implementasi basis Gröbner pada Singular-CAS.

This course aims to introduce the theory of Gröbner bases in multivariable polynomial rings over fields. The course material includes multivariable polynomial rings over fields, ideals, the Hilbert Basis Theorem, term orders, division algorithms, Gröbner bases, reduced Gröbner bases, S-polynomials, the Buchberger algorithm, basic applications of Gröbner bases, and implementation of Gröbner bases using Singular-CAS.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
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Final Examination</td><td>30%</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>Adams, W. W., & Loustaunau, P. (2022). An introduction to Gröbner bases (Vol. 3). American Mathematical Society.
Cox, D., Little, J., O'shea, D., & Sweedler, M. (1997). Ideals, varieties, and algorithms (Vol. 3). New York: Springer.</td></tr>
</table>

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PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

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CO 1			✓				✓			✓	
CO 2							✓				
CO 3			✓							✓	
CO 4							✓			✓	
CO 5								✓			

Date of Last Amendment:
July 27th, 2023

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MODULE HANDBOOK

Module name	Aljabar Linier Lanjut *Advanced Linear Algebra*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060112E06
Courses, if applicable	Aljabar Linier Lanjut *Advanced Linear Algebra*
Semester(s) in which the module is taught	5th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Dewi Ismiarti, M.Si. Intan Nisfulaila, M.Si
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan *Elective course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Aljabar Linier Lanjut sekurang-kurangnya 80% dari pertemuan. *The students have attended the Advanced Linear Algebra course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	Aljabar Linier Elementer Pengantar Struktur Aljabar II *Elementary Linear Algebra* *Introduction to Algebraic Structure II*
Module objectives/intended learning outcomes	Mahasiswa mampu CO1. Mahasiswa mampu memahami konsep ruang vektor atas lapangan, termasuk ruang vektor berdimensi hingga dan tak hingga, serta sifat-sifat dasar yang terkait CO2. Mahasiswa mampu mengidentifikasi dan menganalisis struktur subruang dalam konteks ruang vektor, serta dapat mengaplikasikan

<table>
<tr><td></td><td>pemahaman ini dalam menemukan subruang-subruang dalam situasi nyata
CO3. Mahasiswa mampu menjelaskan konsep basis dan dimensi dalam ruang vektor, serta dapat menghitung dimensi ruang vektor dan memahami peran transformasi linier
CO4. Mahasiswa mampu menerapkan teorema isomorfisma dalam ruang vektor, memahami konsep matriks transformasi linier, perubahan basis, dan keserupaan matriks, serta dapat menganalisis transformasi linier dalam konteks ruang vektor

The students are able to:
CO 1. Understand the concept of vector spaces over fields, including finite-dimensional and infinite-dimensional vector spaces, along with their associated basic properties.
CO 2. Identify and analyze the structure of subspaces within the context of vector spaces and apply this understanding to find subspaces in real-world situations.
CO 3. Explain the concepts of basis and dimension in vector spaces, compute the dimension of vector spaces, and comprehend the role of linear transformations.
CO 4. Apply the isomorphism theorem in vector spaces, understand the concept of matrix representation of linear transformations, change of basis, and matrix similarity, and analyze linear transformations within the context of vector spaces.</td></tr>
<tr><td>Content</td><td>Matakuliah ini membahas ruang vektor (berdimensi hingga maupun tak hingga) atas lapangan secara umum. Materi matakuliah ini meliputi ruang vektor atas lapangan, subruang, himpunan pembangun, bebas linier, basis, dimensi, jumlah langsung, transformasi linier, teorema isomorfisma, matriks transformasi linier, perubahan basis, keserupaan, ruang kuosien.

This course covers vector spaces (both finite-dimensional and infinite-dimensional) over fields in general. The course material includes vector spaces over fields, subspaces, spanning sets, linear independence, basis, dimension, direct sums, linear transformations, the isomorphism theorem, matrix representation of linear transformations, change of basis, similarity, and quotient spaces.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
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Media employed	Whiteboard, Projector, Laptop
Reading List	1. Roman, Steven. 2008. *Advanced Linear Algebra*, 3th ed. Springer. 2. Jacob, Bill. 1990. *Linear Algebra*. W.H and Freeman Company. 3. Arifin, Achmad. 2001. *Aljabar Linier*, Edisi Kedua. Penerbit ITB. 4. Axler, S. (1997). *Linear algebra done right*. Springer Science & Business Media. 5. Lang, S. (1987). Linear algebra.

PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CO 1			✓								
CO 2		✓				✓	✓				
CO 3			✓	✓							
CO 4		✓	✓	✓		✓	✓				

Date of Last Amendment:
July 27th, 2023

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MODULE HANDBOOK

Module name	Komputasi Graf *Computational Graph Theory*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060112E07
Courses, if applicable	Komputasi Graf *Computational Graph Theory*
Semester(s) in which the module is taught	5th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Mohammad Nafie Jauhari, M.Si.
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan *Elective course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Komputasi Graf sekurang-kurangnya 80% dari pertemuan. *The students have attended the Computational Graph Theory course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	Pengantar Teori Graf *Introduction to Graph Theory*
Module objectives/intended learning outcomes	Mahasiswa mampu CO 1. memodelkan permasalah ke dalam graf. CO 2. menyelesaikan permasalahan yang melibatkan teori graf menggunakan komputer. CO 3. menentukan jalur dan rute terpendek dari suatu permasalahan yang bersesuaian. CO 4. mampu membangun graf dari grup dan gelanggang serta menentukan indeks topologinya.

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<table>
<tr><td></td><td>The students are able to:
CO 1. Model problems into graphs.
CO 2. Solve problems involving graph theory using computers.
CO 3. Determine shortest paths and routes for corresponding problems.
CO 4. Construct graphs from groups and rings and determine their topological indices.</td></tr>
<tr><td>Content</td><td>Mata kuliah ini membahas tentang terapan graf dalam menyelesaikan masalah-masalah dunia nyata dengan bantuan Python dan SageMath. Materi yang dipelajari meliputi: Pengenalan Networkx dan Sagemath untuk pemodelan graf, membangun graf secara langsung atau dari data, invarian graf (matriks ketetanggaan, spektrum, polinom karakteristik, bilangan kromatik, polinom kromatik), metrik suatu graf (segregation, centrality, resilience), jarak terpendek, jalur terpendek, pohon merentang minimal, back tracking dengan graf, graf dari suatu Grup atau Gelanggang, indeks topologi suatu graf.

This course covers the application of graphs in solving real-world problems with the assistance of Python and SageMath. The topics studied include: Introduction to Networkx and SageMath for graph modeling, building graphs directly or from data, graph invariants (adjacency matrices, spectrum, characteristic polynomial, chromatic number, chromatic polynomial), graph metrics (segregation, centrality, resilience), shortest paths, spanning trees, backtracking with graphs, graphs from a Group or Ring, and the topological index of a graph.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
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<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>Joyner, D., Van Nguyen, M., & Cohen, N. (2010). Algorithmic graph theory. Google Code, 72-76.
Golumbic, M. C. (2005). Algorithmic graph theory and its applications. Graph theory, combinatorics and algorithms: Interdisciplinary applications, 41-62.
Gibbons, A. (1985). Algorithmic graph theory. Cambridge university press.</td></tr>
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CO 1		✓	✓			✓					
CO 2						✓	✓	✓	✓		
CO 3		✓		✓		✓	✓	✓	✓		
CO 4			✓	✓				✓			
CO 5		✓	✓			✓					
CO 6						✓	✓	✓	✓		

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MODULE HANDBOOK

Module name	Kriptografi *Cryptography*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060112E08
Courses, if applicable	Kriptografi *Cryptography*
Semester(s) in which the module is taught	5th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Muhammad Khudzaifah, M.Si
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan *Elective course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Kriptografi sekurang-kurangnya 80% dari pertemuan. *The students have attended the Cryptography course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	Matematika Diskrit *Discrete Mathematics*
Module objectives/intended learning outcomes	Mahasiswa mampu: CO 1. menjelaskan konsep dasar kriptografi, jenis serangan terhadap sistem kriptografi, serta perbedaan antara kriptografi klasik dan modern. CO 2. menganalisis algoritma kriptografi klasik dan modern, serta mengidentifikasi penggunaan dan keterbatasan masing-masing. CO 3. menjelaskan prinsip kunci privat dan kunci publik dalam kriptografi, serta dapat menjelaskan perbedaan serta penggunaannya dalam keamanan informasi.

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<table>
<tr><td></td><td>CO 4. mengaplikasikan pengetahuan mereka dalam situasi kehidupan sehari-hari yang melibatkan keamanan data, termasuk dalam penggunaan internet dan komunikasi pribadi.
CO 5. merancang solusi keamanan informasi yang efektif dengan memilih dan mengevaluasi metode kriptografi yang sesuai dalam konteks aplikasi tertentu.

The students are able to:
CO 1. Explain the basic concepts of cryptography, types of attacks against cryptographic systems, and the differences between classical and modern cryptography.
CO 2. Analyze classical and modern cryptographic algorithms and identify their uses and limitations.
CO 3. Describe the principles of private key and public key cryptography and explain their differences and usage in information security.
CO 4. Apply their knowledge in everyday life situations involving data security, including internet usage and personal communication.
CO 5. Design effective information security solutions by selecting and evaluating appropriate cryptographic methods within specific application contexts.</td></tr>
<tr><td>Content</td><td>Mata kuliah ini membahas tentang Pengantar Kriptografi, Serangan terhadap Kriptografi, Algoritma Kriptografi Klasik, Algoritma Kriptografi Modern, Kunci Privat Kriptografi, Kunci Publik Kriptografi, dan Kriptografi di kehidupan sehari-hari.

This course covers Introduction to Cryptography, Attacks on Cryptography, Classical Cryptographic Algorithms, Modern Cryptographic Algorithms, Private Key Cryptography, Public Key Cryptography, and Cryptography in Everyday Life.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
The final grade will be weighted as follows:
<table>
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</table></td></tr>
<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>Buchmann, J. (2004). Introduction to cryptography (Vol. 335). New York: Springer.
Delfs, H., Knebl, H., & Knebl, H. (2002). Introduction to cryptography (Vol. 2). Heidelberg: Springer.
Barakat, M., Eder, C., & Hanke, T. (2018). An introduction to cryptography. Timo Hanke at RWTH Aachen University, 1-145.</td></tr>
</table>

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PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CO 1			✓								
CO 2				✓			✓				
CO 3			✓					✓			
CO 4				✓		✓					
CO 5				✓		✓	✓	✓	✓		

Date of Last Amendment:
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MODULE HANDBOOK

Module name	Logika Fuzzy *Fuzzy Logic*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060112E02
Courses, if applicable	Logika Fuzzy *Fuzzy Logic*
Semester(s) in which the module is taught	4th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Evawati Alisah, M.Pd. Mohammad Nafie Jauhari, M.Si.
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan *Elective course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Logika Fuzzy sekurang-kurangnya 80% dari pertemuan. *The students have attended the Fuzzy Logic course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	Logika dan Himpunan *Logic and Set*
Module objectives/intended learning outcomes	Mahasiswa mampu: CO 1. Mengidentifikasi himpunan fuzzy dari himpunan tegas dan menjelaskan konsep dasar himpunan fuzzy. CO 2. Menghitung hasil dari operasi baku dan operasi diperumum dari himpunan fuzzy. CO 3. Membuat model inferensi fuzzy untuk pengambilan keputusan. CO 4. Mengevaluasi dan membandingkan berbagai model inferensi fuzzy dalam konteks aplikasi yang berbeda.

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<table>
<tr><td></td><td>The students are able to:
CO 1. Identify fuzzy sets from crisp sets and explain the basic concepts of fuzzy sets.
CO 2. Calculate the results of standard operations and generalized operations of fuzzy sets.
CO 3. Create fuzzy inference models for decision making.
CO 4. Evaluate and compare various fuzzy inference models in different application contexts.</td></tr>
<tr><td>Content</td><td>Mata kuliah ini membahas: Pengantar logika dan himpunan tegas, Himpunan fuzzy, Fungsi keanggotaan dan operasi baku himpunan fuzzy, Perumuman operasi baku himpunan fuzzy, Potongan-α, Relasi fuzzy, Bilangan fuzzy, Logika fuzzy, dan Inferensi Fuzzy serta aplikasinya.

This course covers: Introduction to logic and crisp sets, Fuzzy sets, Membership functions and basic operations of fuzzy sets, Generalization of basic operations of fuzzy sets, a-cuts, Fuzzy relations, Fuzzy numbers, Fuzzy logic, and Fuzzy inference and its applications.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
The final grade will be weighted as follows:
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<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>Susilo, F. (2006). Himpunan dan logika kabur serta aplikasinya. Yogyakarta: Graha Ilmu.
Zadeh, L. A. (1988). Fuzzy logic. Computer, 21(4), 83-93.</td></tr>
</table>

PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CO 1			✓								
CO 2			✓					✓			
CO 3				✓		✓	✓	✓	✓		
CO 4				✓		✓		✓			

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MODULE HANDBOOK

Module name	Pemrograman Kriptografi *Cryptographic Programming*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060112E11
Courses, if applicable	Pemrograman Kriptografi *Cryptographic Programming*
Semester(s) in which the module is taught	6th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Muhammad Khudzaifah, M.Si.
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan *Elective course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Pemrograman Kriptografi sekurang-kurangnya 80% dari pertemuan. *The students have attended the Introduction to Cryptographic Programming course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	Pengantar Kriptografi *Introduction to Cryptography*
Module objectives/intended learning outcomes	Mahasiswa mampu: CO 1. mengimplementasikan algoritma kriptografi untuk mengamankan data dan citra serta memahami prinsip-prinsip dasar pengamanan informasi. CO 2. merancang sistem keamanan terhadap serangan kriptanalisis, mengidentifikasi kerentanannya, dan menerapkan teknik perlindungan yang sesuai. CO 3. mengaplikasikan konsep kriptografi dalam situasi kehidupan sehari-hari, seperti penggunaan aplikasi keamanan data dan enkripsi komunikasi.

<table>
<tr><td></td><td>CO 4. merancang dan mengimplementasikan aplikasi kriptografi dalam konteks kehidupan sehari-hari serta mengevaluasi efektivitasnya dalam melindungi data dan informasi.

The students are able to:
CO 1. Implement cryptographic algorithms to secure data and images and understand the basic principles of information security.
CO 2. Design security systems against cryptanalysis attacks, identify vulnerabilities, and apply appropriate protection techniques.
CO 3. Apply cryptographic concepts in everyday situations, such as using data security applications and encrypted communication.
CO 4. Design and implement cryptographic applications in everyday life contexts and evaluate their effectiveness in protecting data and information.</td></tr>
<tr><td>Content</td><td>Mata kuliah ini membahas tentang implementasi algoritma kriptografi, pengamanan data dan citra, sistem yang aman terhadap serangan kriptanalisis dan Aplikasi Kriptografi di kehidupan sehari-hari.

This course covers the implementation of cryptographic algorithms, data and image security, secure systems against cryptanalysis attacks, and Cryptographic Applications in everyday life.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
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<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>Bray, S. W. (2020). Implementing Cryptography using Python. John Wiley & Sons.
Acitelli, C. B. (2022). The Design of an Undergraduate Cryptography Course with Python and SageMath. North Carolina State University.
Reddy, P. M., & Vidhyapeetham, A. V. Attacks on Elliptic Curve Cryptography Implementations in Sage Math.
Bowne, S. (2018). Hands-On Cryptography with Python: Leverage the power of Python to encrypt and decrypt data. Packt Publishing Ltd.
Nielson, S. J., & Monson, C. K. (2019). Practical Cryptography in Python: Learning Correct Cryptography by Example. Apress.</td></tr>
</table>

PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

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CO 1				✓							
CO 2	✓			✓			✓	✓			
CO 3	✓	✓						✓			
CO 4		✓		✓			✓	✓	✓		

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MODULE HANDBOOK

Module name	Pengantar Teori Graf *Introduction to Graph Theory*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060112E04
Courses, if applicable	Pengantar Teori Graf *Introduction to Graph Theory*
Semester(s) in which the module is taught	4th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Dr. Abdussakir, M.Pd. Mohammad Nafie Jauhari, M.Si.
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan *Elective course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Pengantar Teori Graf sekurang-kurangnya 80% dari pertemuan. *The students have attended the Introduction to Graph Theory course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	Logika dan Himpunan *Logic and Set*
Module objectives/intended learning outcomes	Mahasiswa mampu: CO 1. Menjelaskan prinsip-prinsip dasar dalam teori graf, termasuk konsep titik, sisi, dan jenis-jenis graf. CO 2. Mengidentifikasi dan menerapkan teknik representasi graf yang sesuai dalam konteks pemodelan masalah. CO 3. Mampu merancang dan menghasilkan graf pohon serta memahami metode pembentukan graf pohon minimal.

<table>
<tr><td></td><td>CO 4. Mampu menjelaskan konsep pewarnaan graf dan prinsip dekomposisi dalam konteks graf, serta menggambarkan aplikasi teori graf dalam berbagai permasalahan terkait.

The students are able to:
CO 1. Explain the basic principles of graph theory, including concepts of vertices, edges, and types of graphs.
CO 2. Identify and apply appropriate graph representation techniques in the context of problem modeling.
CO 3. Design and generate tree graphs and understand methods for constructing minimal spanning tree graphs.
CO 4. Explain the concept of graph coloring and decomposition principles in the context of graphs and describe applications of graph theory in various related problems.</td></tr>
<tr><td>Content</td><td>Mata kuliah ini membahas konsep dasar graf sederhana dan multigraf, termasuk aspek-aspek penting seperti ketetanggaan, keterkaitan, derajat titik, dan barisan derajat. Materi juga meliputi subgraf, subgraf terinduksi, serta berbagai operasi graf seperti komplemen, subdivisi, graf garis, dan perkalian. Selain itu, terdapat pembahasan mengenai keterhubungan graf melalui lintasan, trail, sirkuit, siklus, dan cut set, serta jenis-jenis graf khusus seperti graf regular, komplit, kosong, bintang, wheel, Petersen, dan graf bipartit. Topik lainnya mencakup graf Euler dan Hamilton, konsep pohon rentang minimum dan pohon jarak terpendek, algoritma Kruskal dan Prim, planaritas, dualitas, pewarnaan graf, graf terarah, dan hubungan antara matriks dengan graf/digraf.

This course covers the basic concepts of simple and multigraphs, including important aspects such as adjacency, connectivity, vertex degree, and degree sequences. The material also includes subgraphs, induced subgraphs, and various graph operations such as complement, subdivision, line graph, and product. Additionally, there is discussion on graph connectivity through paths, trails, circuits, cycles, and cut sets, as well as special types of graphs such as regular, complete, empty, star, wheel, Petersen, and bipartite graphs. Other topics include Euler and Hamiltonian graphs, concepts of minimum spanning trees and shortest path trees, Kruskal's and Prim's algorithms, planarity, duality, graph coloring, directed graphs, and the relationship between matrices and graphs/digraphs.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
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</table></td></tr>
</table>

Media employed	Whiteboard, Projector, Laptop
Reading List	Chartrand, G., & Zhang, P. (2013). *A First Course in Graph Theory*. Courier Corporation. Wilson, R. J. (2010). *Introduction to Graph Theory, 5th edition*. Pearson Education.

PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CO 1			✓								
CO 2		✓		✓			✓				
CO 3		✓					✓	✓			
CO 4			✓				✓				

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MODULE HANDBOOK

Module name	Pengantar Teori Latis *Introduction to Lattice Theory*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060112E14
Courses, if applicable	Pengantar Teori Latis *Introduction to Lattice Theory*
Semester(s) in which the module is taught	6th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Evawati Alisah, M.Pd
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan *Elective course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Pengantar Teori Latis sekurang-kurangnya 80% dari pertemuan. *The students have attended the Introduction to Lattice Theory course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	Logika dan Himpunan *Logic and Set*
Module objectives/intended learning outcomes	Mahasiswa mampu: CO 1. Menjelaskan konsep dasar teori latis, termasuk definisi latis, sifat-sifat fundamentalnya, dan perbedaan antara latis dan struktur aljabar lainnya. CO 2. Mampu mengidentifikasi dan menganalisis sublatis dalam suatu latis, serta memahami bagaimana sublatis memengaruhi struktur keseluruhan. CO 3. Menguasai operasi join (resepsi) dan meet (ideal) dalam teori latis serta dapat mengaplikasikannya dalam pemodelan masalah.

<table>
<tr><td></td><td>CO 4. Mengenal aplikasi teori lattice dalam berbagai bidang seperti aljabar boolean dan ilmu komputer, dan memahami bagaimana lattice digunakan dalam pemodelan masalah di bidang tersebut.

The students are able to:
CO 1. Explain the basic concepts of lattice theory, including lattice definitions, fundamental properties, and the differences between lattices and other algebraic structures.
CO 2. Identify and analyze sublattices within a lattice and understand how sublattices affect the overall structure.
CO 3. Master the join (union) and meet (intersection) operations in lattice theory and apply them in problem modeling.
CO 4. Recognize applications of lattice theory in various fields such as Boolean algebra and computer science and understand how lattices are used in problem modeling in these fields.</td></tr>
<tr><td>Content</td><td>Mata kuliah ini mempelajari konsep dasar teori latis, seperti definisi latis, sifat-sifatnya, sublatis, serta operasi join dan meet. Materi juga mencakup ordinal latis, diagram Hasse, dan aplikasi dalam berbagai bidang, termasuk aljabar Boole dan ilmu komputer. Selain itu, mahasiswa akan terlibat dalam latihan dan studi kasus untuk menerapkan konsep-konsep latis dalam konteks pemecahan masalah nyata.

This course covers the basic concepts of lattice theory, such as lattice definitions, properties, sublattices, as well as join and meet operations. The material also includes ordinal lattices, Hasse diagrams, and applications in various fields, including Boolean algebra and computer science. Additionally, students will engage in exercises and case studies to apply lattice concepts in the context of solving real-world problems.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
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<table>
<tr><th>No.</th><th>Metode Penilaian
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Final Examination</td><td>30%</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>Grätzer, G. (2002). General lattice theory. Springer Science & Business Media.
Garg, V. K. (2015). Introduction to lattice theory with computer science applications. John Wiley & Sons.
Birkhoff, G. (1940). Lattice theory (Vol. 25). American Mathematical Soc..</td></tr>
</table>

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PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CO 1			✓								
CO 2			✓	✓			✓			✓	
CO 3			✓								
CO 4				✓			✓				

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MODULE HANDBOOK

Module name	Pengantar Teori Modul *Introduction to Module Theory*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060112E12
Courses, if applicable	Pengantar Teori Modul *Introduction to Module Theory*
Semester(s) in which the module is taught	6th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Dewi Ismiarti, M.Si
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan *Elective course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Pengantar Teori Modul sekurang-kurangnya 80% dari pertemuan. *The students have attended the Introduction to Module Theory course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	Pengantar Struktur Aljabar II *Introduction to Algebraic Structure II*
Module objectives/intended learning outcomes	Mahasiswa mampu CO 1. membuktikan sifat-sifat dasar modul dan submodul CO 2. mengembangkan konsep-konsep dasar ruang vektor terkait basis dan transformasi linier ke modul CO 3. menjelaskan jenis-jenis modul dan sifat-sifatnya *Students are able to* *CO 1. prove elementary properies of modules and submodules* *CO 2. develop elementary concept of vector spaces to modules such as bases and linear transformations*

<table>
<tr><td></td><td>CO 3. explain some kinds of modules and their properties</td></tr>
<tr><td>Content</td><td>Matakuliah ini bertujuan memperkenalkan struktur modul atas gelanggang sebagai perumuman dari ruang vektor atas lapangan. Materi yang dibahas dalam matakuliah ini meliputi modul atas gelanggang, submodul, modul yang dibangun oleh himpunan, modul siklis, modul torsi, annihilator, modul bebas, jumlah langsung modul, modul kuosien, homomorfisma modul, kondisi rantai pada submodul-submodul, modul Noether, modul Artin, modul sederhana.

This course aims to introduce the module structure over rings as a generalization of vector spaces over fields. The topics covered in this course include modules over rings, submodules, modules constructed by sets, cyclic modules, torsion modules, annihilators, free modules, direct sum of modules, quotient modules, module homomorphisms, chain conditions on submodules, Noetherian modules, Artinian modules, and simple modules.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
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</table></td></tr>
<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>1. Roman, Steven. 2008. Advanced Linear Algebra 3rd edition. New York : Springer.
2. Blyth, T.S. 1977. Module Theory. Oxford : Oxford University Press.
3. Passman, D.S. 2004. A Course in Ring Theory. USA : AMS.
4. Hartley, B. 1970. Rings, Modules and Linear Algebra. Great Britain : Cambridge University Press.</td></tr>
</table>

PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CO 1			✓							✓	
CO 2							✓			✓	
CO 3							✓			✓	

CO 4			✓				✓				

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MODULE HANDBOOK

Module name	Pengantar Teori Representasi *Introduction to Representation Theory*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060112E13
Courses, if applicable	Pengantar Teori Representasi *Introduction to Representation Theory*
Semester(s) in which the module is taught	6th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Intan Nisfulaila, M.Si.
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan *Elective course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Pengantar Teori Representasi sekurang-kurangnya 80% dari pertemuan. *The students have attended the Introduction to Representation Theory course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	Logika dan Himpunan Aljabar Linier Elementer Struktur Aljabar I
Module objectives/intended learning outcomes	Mahasiswa mampu: CO 1. menjelaskan matriks transformasi linier CO 2. membuktikan suatu grup aljabar CO 3. membuktikan homomorfisma atas aljabar CO 4. menggunakan Teorema Maschke dan Lema Schur dalam pembuktian pernyataan matematika

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	Students are able to: *CO 1. explain the matrices of linear transformations.* *CO 2. prove a given algebraic group.* *CO 3. demonstrate homomorphism over algebra.* *CO 4. apply Maschke's Theorem and Schur's Lemma in the proof of mathematical statements.*
Content	Mata kuliah ini membahas sifat-sifat matriks representasi transformasi linier, representasi grup atas ruang vektor, modul atas aljabar, grup aljabar, homomorfisma atas aljabar, serta teorema maschke dan lema schur. *This course covers the properties of matrices representing linear transformations, group representations over vector spaces, modules over algebras, algebraic groups, homomorphisms over algebras, as well as Maschke's Theorem and Schur's Lemma.*
Study and examination requirements and forms of examination	Nilai akhir akan diberi bobot sebagai berikut: *The final grade will be weighted as follows:*
Media employed	Whiteboard, Projector, Laptop
Reading List	James, G. D., & Liebeck, M. W. (2001). *Representations and characters of groups*. Cambridge university press.

No.	Metode Penilaian *Assessment Methods*	Bobot *Weight*
1	Tugas *Assignment*	20%
2	Kuis *Quiz*	20%
3	UTS *Midterm Examination*	30%
4	UAS *Final Examination*	30%

PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

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CO 4				✓						✓	

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MODULE HANDBOOK

Module name	Teori Bilangan *Number Theory*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060112E03
Courses, if applicable	Teori Bilangan *Number Theory*
Semester(s) in which the module is taught	4th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Prof. Dr. Turmudi, M.Si., Ph.D. Evawati Alisah, M.Pd. Muhammad Khudzaifah, M.Si.
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan *Elective course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Teori Bilangan sekurang-kurangnya 80% dari pertemuan. *The students have attended the Number Theory course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	
Module objectives/intended learning outcomes	CO 1. Mahasiswa mampu menganalisis bilangan prima dalam suatu rentang dan memahami dasar kriteria keprimaan. CO 2. Mahasiswa mampu mengaplikasikan konsep kongruensi untuk memecahkan masalah matematika dan memilih metode kongruensi yang tepat. CO 3. Mahasiswa mampu mengidentifikasi residu kuadratik dalam bilangan bulat serta mengaplikasikan konsep residu kuadratik dalam konteks teori bilangan dan kriptografi.

<table>
<tr><td></td><td>CO 4. Mahasiswa mampu menjelaskan fungsi-fungsi multiplikatif, seperti fungsi Euler totien, dan menghitung nilai-nilai fungsi tersebut dalam berbagai konteks matematis.
CO 5. Mahasiswa mampu menyelesaikan persamaan diophantine dengan metode yang sesuai dan menjelaskan langkah-langkah pemecahan masalah secara matematis.

Students are able to:
CO 1. Analyze prime numbers within a given range and understand the basic criteria for primality.
CO 2. Apply the concept of congruences to solve mathematical problems and select the appropriate method of congruence.
CO 3. Identify quadratic residues in integers and apply the concept of quadratic residues in the context of number theory and cryptography.
CO 4. Explain multiplicative functions, such as the Euler totient function, and calculate their values in various mathematical contexts.
CO 5. Solve Diophantine equations using appropriate methods and explain the steps of mathematical problem-solving.</td></tr>
<tr><td>Content</td><td>Mata kuliah ini membahas prinsip-primsip dasar pada bilangan bulat, keterbagian, keprimaan dan ciri keterbagian, kongruensi, residu kuadratis, fungsi-fungsi multiplikatif, persamaan diophatine.

This course covers the fundamental principles of integers, divisibility, primality and divisibility traits, congruences, quadratic residues, multiplicative functions, and Diophantine equations.</td></tr>
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</table></td></tr>
<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>Rosen, K. H. (2011). Elementary number theory. London: Pearson Education.
Dudley, U. (2012). Elementary number theory. Courier Corporation.
Ireland, K., & Rosen, M. I. (1990). A classical introduction to modern number theory (Vol. 84). Springer Science & Business Media.</td></tr>
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CO 1			✓								
CO 2				✓						✓	
CO 3			✓							✓	
CO 4			✓	✓							
CO 5				✓						✓	

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MODULE HANDBOOK

Module name	Teori Grup Hingga *Finite Group Theory*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060112E05
Courses, if applicable	Teori Grup Hingga *Finite Group Theory*
Semester(s) in which the module is taught	4th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Intan Nisfulaila, M.Si.
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan *Elective course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Teori Grup Hingga sekurang-kurangnya 80% dari pertemuan. *The students have attended the Finite Group Theory course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	Logika dan Himpunan *Logic and Set*
Module objectives/intended learning outcomes	Mahasiswa mampu: CO 1. mengidentifikasi sifat-sifat suatu grup permutasi CO 2. memahami dan menggunakan Teorema Lagrange dalam konteks grup hingga untuk menyelesaikan masalah matematika, termasuk pembuktian dan aplikasi dalam struktur grup. CO 3. menerapkan Teorema Cauchy dalam analisis dan pembuktian sifat-sifat grup hingga, serta eksplorasi kasus-kasus khusus dimana teorema tersebut dapat diaplikasikan.

<table>
<tr><td></td><td>CO 4. memahami dan menerapkan Teorema Sylow dalam pengelompokan subgrup Sylow dari grup hingga, dan mengidentifikasi hubungan antara teorema tersebut dengan struktur grup.

Students are able to:
CO 1. identify the properties of a permutation group.
CO 2. understand and utilize Lagrange's Theorem in the context of finite groups to solve mathematical problems, including proofs and applications within group structures.
CO 3. apply Cauchy's Theorem in the analysis and proof of properties of finite groups, as well as exploring specific cases where the theorem can be applied.
CO 4. comprehend and implement Sylow's Theorems in the categorization of Sylow subgroups of finite groups and identify the relationship between these theorems and the group structure.</td></tr>
<tr><td>Content</td><td>Mata kuliah ini membahas sifat-sifat grup permutasi, Teorema Lagrange, Teorema Cauchy, serta Teorema Sylow dan aplikasinya.

This course covers the properties of permutation groups, Lagrange's Theorem, Cauchy's Theorem, as well as Sylow's Theorems and their applications.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:
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<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>Serre, J. P. (2016). Finite groups: an introduction (Vol. 10). Somerville, MA: International Press.
Aschbacher, M. (2000). Finite group theory (Vol. 10). Cambridge University Press.</td></tr>
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CO 2			✓							✓	
CO 3				✓						✓	
CO 4			✓	✓						✓	

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MODULE HANDBOOK

Module name	Teori Pengkodean *Coding Theory*
Module level, if applicable	Sarjana/S1 *Bachelor*
Code, if applicable	22060112E09
Courses, if applicable	Logika Fuzzy *Fuzzy Logic*
Semester(s) in which the module is taught	5th
Person responsible for the module	Ketua Konsorsium Aljabar *Chair of Algebra Consortium*
Lecturers	Muhammad Khudzaifah, M.Si.
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan *Elective course*
Teaching methods	Ceramah, diskusi, pemecahan masalah *Lecture, classroom discussion, problem solving*
Workload	Total beban perkuliahan adalah 136 jam per semester, yang terdiri atas 150 menit perkuliahan per minggu selama 14 minggu, 180 menit aktivitas terstruktur per minggu, 180 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS. *The overall workload for each semester is 136 hours. This includes 150 minutes of weekly lectures for 14 weeks, 180 minutes of structured activities per week, and 180 minutes of individual study each week, summing up to 16 weeks per semester, encompassing both mid-term and final examinations.*
Credit points	3 Credits (4.41 ECTS)
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Teori Pengkodean sekurang-kurangnya 80% dari pertemuan. *The students have attended the Coding Theory course for a minimum of 80% of the scheduled sessions.*
Recommended prerequisites	Aljabar Linier Elementer *Elementary Linear Algebra*
Module objectives/intended learning outcomes	Mahasiswa mampu: CO1. menjelaskan prinsip-prinsip dasar teori koding, termasuk deteksi error, koreksi error, dan dekoding dalam konteks komunikasi. CO2. menerapkan metode deteksi dan koreksi kesalahan dalam transmisi data serta mengidentifikasi karakteristik kode linear. CO3. memahami konsep lapangan hingga dan bagaimana itu berkaitan dengan teori koding. CO4. menerapkan pengetahuan mereka dalam teori koding untuk merancang solusi efektif dalam pemecahan masalah komunikasi data dan koreksi kesalahan.

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	Students are able to: *CO1. Explain the fundamental principles of coding theory, including error detection, error correction, and decoding in the context of communication.* *CO2. Implement methods for error detection and correction in data transmission and identify the characteristics of linear codes.* *CO3. Understand the concept of finite fields and how it relates to coding theory.* *CO4. Apply their knowledge in coding theory to design effective solutions for data communication issues and error correction.*
Content	Mata kuliah ini membahas: pengantar teori koding, deteksi error, koreksi dan dekoding, lapangan hingga, kode linear, batas-batas dalam teori koding. *This course covers an introduction to coding theory, error detection, correction and decoding, finite fields, linear codes, and bounds in coding theory.*
Study and examination requirements and forms of examination	Nilai akhir akan diberi bobot sebagai berikut: *The final grade will be weighted as follows:*
Media employed	Whiteboard, Projector, Laptop
Reading List	Neubauer, A., Freudenberger, J., & Kuhn, V. (2007). *Coding theory: algorithms, architectures and applications*. John Wiley & Sons. Van Lint, J. H. (1998). *Introduction to coding theory* (Vol. 86). Springer Science & Business Media. Rhee, M. Y. (1989). *Error-correcting coding theory*. McGraw-Hill, Inc..

No.	Metode Penilaian *Assessment Methods*	Bobot *Weight*
1	Tugas *Assignment*	20%
2	Kuis *Quiz*	20%
3	UTS *Midterm Examination*	30%
4	UAS *Final Examination*	30%

PLO and CO Mapping (The PLO is available on https://s.id/PLOMatematika)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CO 1			✓	✓			✓				
CO 2				✓				✓			
CO 3			✓								
CO 4				✓			✓	✓			

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MODULE HANDBOOK

Module name	Aljabar Matriks
Module level, if applicable	Sarjana/S1
Code, if applicable	#N/A
Courses, if applicable	Aljabar Matriks
Semester(s) in which the module is taught	0
Person responsible for the module	Ketua konsorsium Aljabar
Lecturers	[?]Nama lengkap dosen beserta gelar 1. Mohammad Nafie Jauhari, M.Si 2. Muhammad Khudzaifah, M.Si
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan semester 0
Type of teaching, contact hours	0 menit tatap muka dan 0 menit aktivitas terstruktur per minggu.
Workload	Total beban perkuliahan adalah 0.0 jam per semester, yang terdiri atas 0 menit perkuliahan per minggu selama 14 minggu, 0 menit aktivitas terstruktur per minggu, 0 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS.
Credit points	0
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Aljabar Matriks sekurang-kurangnya 80% dari pertemuan.
Recommended prerequisites	
Module objectives/intended learning outcomes	CO1. Mahasiswa mampu memahami konsep keserupaan matriks dan dapat mengidentifikasi karakteristik serta sifat keserupaan matriks CO2. Mahasiswa mampu mengenali dan menjelaskan tipe-tipe matriks spesial, serta memahami aplikasi dan sifat-sifat khusus yang terkait dengan matriks-matriks tersebut CO3. Mahasiswa mampu menjelaskan konsep komplemen Schur dalam konteks matriks, serta memahami peran dan aplikasi komplemen Schur dalam perhitungan matriks CO4. Mahasiswa mampu memahami konsep kenormalan matriks dan dapat mengenali kriteria kenormalan pada matriks, serta mengidentifikasi situasi di mana kenormalan matriks menjadi relevan
Content	Matakuliah ini membahas keserupaan matriks, tipe-tipe matriks spesial, komplemen Schur, kenormalan matriks.

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Study and examination requirements and forms of examination	Nilai akhir akan diberi bobot sebagai berikut: No. Metode Penilaian Bobot 1 UAS 40% 2 UTS 40% 3 Kuis, Tugas 20% Nilai akhir ditentukan dengan kriteria berikut: Range | Grade [85 – 100] | A [75 – 85) | B+ [70 – 75) | B [65 – 70) | C+ [60 – 65) | C [50 – 60) | D
Media employed	Whiteboard, Projector, Laptop
Reading List	Abadir, K. M., & Magnus, J. R. (2005). *Matrix algebra* (Vol. 1). Cambridge University Press. Gentle, J. E. (2007). Matrix algebra. Springer texts in statistics, Springer, New York, NY, doi, 10, 978-0.

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MODULE HANDBOOK

Module name	Pengantar Aljabar Komutatif
Module level, if applicable	Sarjana/S1
Code, if applicable	#N/A
Courses, if applicable	Pengantar Aljabar Komutatif
Semester(s) in which the module is taught	0
Person responsible for the module	Ketua konsorsium Aljabar
Lecturers	1. Intan Nisfulaila, M.Si.
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan semester 0
Type of teaching, contact hours	0 menit tatap muka dan 0 menit aktivitas terstruktur per minggu.

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Workload	Total beban perkuliahan adalah 0.0 jam per semester, yang terdiri atas 0 menit perkuliahan per minggu selama 14 minggu, 0 menit aktivitas terstruktur per minggu, 0 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS.
Credit points	0
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Pengantar Aljabar Komutatif sekurang-kurangnya 80% dari pertemuan.
Recommended prerequisites	Logika dan Himpunan Aljabar Linier Elementer
Module objectives/intended learning outcomes	Mahasiswa mampu CO 1. menjelaskan teorema-teorema dasar aljabar komutatif CO 2. menerapkan teorema-teorema untuk membuktikan sifat-sifat ring komutatif dan modul atasnya
Content	Matakuliah ini membahas teorema-teorema fundamental dari aljabar komutatif serta penerapannya. Kajian matakuliah ini meliputi operasi ideal, radikal, lokalisasi, kondisi rantai, dekomposisi primer, integral extensions, teori dimensi, daerah Dedekind, daerah valuasi diskrit
Study and examination requirements and forms of examination	Nilai akhir akan diberi bobot sebagai berikut: No. Metode Penilaian Bobot 1 UAS 40% 2 UTS 40% 3 Kuis, Tugas 20% Nilai akhir ditentukan dengan kriteria berikut: **Range** / **Grade** [85 – 100] A [75 – 85) B+ [70 – 75) B [65 – 70) C+ [60 – 65) C [50 – 60) D
Media employed	Whiteboard, Projector, Laptop
Reading List	Eisenbud, D. (2013). *Commutative algebra: with a view toward algebraic geometry* (Vol. 150). Springer Science & Business Media.

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MODULE HANDBOOK

Module name	Pengantar Quiver
Module level, if applicable	Sarjana/S1
Code, if applicable	#N/A
Courses, if applicable	Pengantar Quiver
Semester(s) in which the module is taught	0
Person responsible for the module	Ketua konsorsium Aljabar
Lecturers	[?]Nama lengkap dosen beserta gelar 1. Mohammad Nafie Jauhari, M.Si 2. Muhammad Khudzaifah, M.Si
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan semester 0
Type of teaching, contact hours	0 menit tatap muka dan 0 menit aktivitas terstruktur per minggu.
Workload	Total beban perkuliahan adalah 0.0 jam per semester, yang terdiri atas 0 menit perkuliahan per minggu selama 14 minggu, 0 menit aktivitas terstruktur per minggu, 0 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS.
Credit points	0
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Pengantar Quiver sekurang-kurangnya 80% dari pertemuan.
Recommended prerequisites	[?]MK prasyarat
Module objectives/intended learning outcomes	CO1. Mahasiswa mampu memahami konsep dasar teori quivers dan representasi-representasi quivers serta mengenali peran pentingnya dalam konteks penelitian aljabar nonkomutatif CO2. Mahasiswa mampu menjelaskan prinsip-prinsip aljabar dimensi terbatas, quivers, dan aljabar jalur quiver serta mengidentifikasi tujuan utama dalam pembuktian teorema Gabriel yang mengkarakterisasi aljabar jalur terbatas yang terkait dengan quivers tipe A, D, atau E CO3. Mahasiswa mampu mengidentifikasi dan menganalisis topik tambahan yang relevan terkait quivers, seperti kesetaraan Morita, resolusi proyek, dimensi global, dan sistem akar CO4. Mahasiswa mampu menjelaskan korespondensi McKay dan memahami bagaimana topik ini berhubungan dengan quivers serta kemungkinan kaitannya dengan aljabar geometri CO5. Mahasiswa mampu menerapkan pengetahuan mereka dalam merancang solusi dan menganalisis masalah terkait quivers dalam konteks aljabar nonkomutatif serta memahami relevansi subjek ini terhadap bidang matematika lainnya, seperti aljabar geometri

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<table>
<tr><td>Content</td><td>Mata kuliah ini membahas bahasa dan teori quivers serta representasi-representasi quivers, topik yang memiliki peran penting dalam penelitian aljabar nonkomutatif dan memiliki relevansi dengan subjek-subjek seperti aljabar geometri. Materi awal kuliah ini melibatkan pemahaman dasar aljabar dimensi terbatas, quivers, dan aljabar jalur quiver, dengan tujuan untuk membuktikan teorema Gabriel yang mengkarakterisasi aljabar jalur terbatas sebagai yang terkait dengan quivers tipe A, D, atau E. Materi lanjutan dari kuliah ini berfokus pada topik tambahan terkait quivers, seperti korespondensi McKay.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>Nilai akhir akan diberi bobot sebagai berikut:

No. Metode Penilaian Bobot
1 UAS 40%
2 UTS 40%
3 Kuis, Tugas 20%

Nilai akhir ditentukan dengan kriteria berikut:

<table><tr><th>Range</th><th>Grade</th></tr><tr><td>[85 – 100]</td><td>A</td></tr><tr><td>[75 – 85)</td><td>B+</td></tr><tr><td>[70 – 75)</td><td>B</td></tr><tr><td>[65 – 70)</td><td>C+</td></tr><tr><td>[60 – 65)</td><td>C</td></tr><tr><td>[50 – 60)</td><td>D</td></tr></table></td></tr>
<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>Derksen, H., & Weyman, J. (2017). An introduction to quiver representations (Vol. 184). American Mathematical Soc.
Schiffler, R. (2014). Quiver representations (Vol. 1). Cham: Springer.</td></tr>
</table>

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MODULE HANDBOOK

Module name	Teori Himpunan
Module level, if applicable	Sarjana/S1
Code, if applicable	#N/A
Courses, if applicable	Teori Himpunan
Semester(s) in which the module is taught	0
Person responsible for the module	Ketua konsorsium Aljabar
Lecturers	1. Dewi Ismiarti, M.Si. 2. Mohammad Nafie Jauhari, M.Si
Language	Bahasa Indonesia
Relation to curriculum	Mata kuliah pilihan semester 0
Type of teaching, contact hours	0 menit tatap muka dan 0 menit aktivitas terstruktur per minggu.
Workload	Total beban perkuliahan adalah 0.0 jam per semester, yang terdiri atas 0 menit perkuliahan per minggu selama 14 minggu, 0 menit aktivitas terstruktur per minggu, 0 menit belajar mandiri per minggu, dengan total 16 minggu per semester termasuk UTS dan UAS.
Credit points	0
Requirements according to the examination regulations	Mahasiswa telah mengikuti mata kuliah Teori Himpunan sekurang-kurangnya 80% dari pertemuan.
Recommended prerequisites	Logika dan Himpunan
Module objectives/intended learning outcomes	Mahasiswa mampu CO 1. membedakan himpunan hingga, takhingga, dan denumerable CO 2. menjelaskan sifat khusus bilangan kardinal dari himpunan takhingga CO 3. menjelaskan himpunan terkait konsistensi dan independensi dalam teori himpunan
Content	Mata kuliah ini membahas himpunan himpunan hingga, himpunan takhingga, himpunan denumerable, aritmatika bilangan kardinal suatu himpunan, aritmatika bilangan ordinal, konsistensi dan independensi dalam teori himpunan
Study and examination requirements and forms of examination	Nilai akhir akan diberi bobot sebagai berikut: No. Metode Penilaian Bobot 1 UAS 40% 2 UTS 40% 3 Kuis, Tugas 20%

<table>
<tr><td></td><td>Nilai akhir ditentukan dengan kriteria berikut:
<table>
<tr><th>Range</th><th>Grade</th></tr>
<tr><td>[85 – 100]</td><td>A</td></tr>
<tr><td>[75 – 85)</td><td>B+</td></tr>
<tr><td>[70 – 75)</td><td>B</td></tr>
<tr><td>[65 – 70)</td><td>C+</td></tr>
<tr><td>[60 – 65)</td><td>C</td></tr>
<tr><td>[50 – 60)</td><td>D</td></tr>
</table></td></tr>
<tr><td>Media employed</td><td>Whiteboard, Projector, Laptop</td></tr>
<tr><td>Reading List</td><td>Pinter, C. C. (2014). A book of set theory. Courier Corporation.
Rodgers, N. (2000). Learning to reason: an introduction to logic, sets, and relations. John Wiley & Sons.</td></tr>
</table>

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