	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Doctoral Study Program in Mathematics Education	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Algebra (Algebra)	8400203062		T=3	P=0	ECTS=7.56	2	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Prof. Dr. Tatag Yuli Eko Siswono, S.Pd., M.Pd.

Learning model	**Case Studies**
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**
	Program Objectives (PO)
	PLO-PO Matrix

P.O

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Short Course Description	Study of the basic properties of polynomial rings, upper modules of Euclidean rings, and vector spaces, and is directed at field expansions and corresponding automorphism groups as well as linear transformation algebra and matrix algebra as well as canonical forms of linear transformation. The discussion of field expansions will include algebraic, simple, and normal expansions as well as the existence of expansions of a field that contains the roots of polynomials over that field. The study of automorphism groups includes Galois groups, fixed fields, and the relationship between normal subgroups of automorphism and normal expansion. Canonical forms of linear transformations include triangular, Jordan, and rational forms. Lectures begin with an explanation of concepts and principles, assignments and discussions with students, as well as presentations using ICT with an assessment system including assignments (30%), participation (20%), mid-semester assessment (20%) and final semester assessment (30%).
References	**Main :**

1. Anderson, M., & Feil, T. 2015. First course in abstract Algebra . CRC Press.
2. Carstensen, C., Fine, B., & Rosenberger, G. 2011. Abstract algebra- applications to galois theory, algebraic geometry, and cryptography . Berlin: Walter de Gruyter GmbH & Co.
3. Gallian, J. A. 2013. Contemporary abstract algebra . Brooks/Cole, Cengage Learning.
4. Herstein, I. N. 1996. Abstract Algebra . Wiley Pearson.
5. Hodge, J. K., Schlicker, S., & Sundstrom, T. 2014. Abstract Algebra An Inquiry-based Approach . CRC Press.
6. Hungerford, T. W. 2014. Abstract algebra-an introduction. Boston: Brooks/Cole, Cengage Learning.
7. Lorenz, F. 2006. Algebra, Volume I: Fields and galois theory. New York: Springer Science Business Media.
8. Paulsen, W.2010. Abstract algebra-an interactive approach . New York: CRC Press.

Supporters:	
Supporting lecturer	Dr. Agung Lukito, M.S.

Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [Estimated time]		Learning materials [References]	Assessment Weight (%)
		Indicator	Criteria & Form	Offline (*offline*)	Online (*online*)		

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Understand the concept of expanding a field	Presents evidence of the relationship between the degrees of expansion between related fields. Determine the external and internal description of the smallest subfield that contains a field and an element in its extension. Explains the relationship between the algebraic properties of an element in an expansion and the degree of expansion of the smallest subfield containing that element.		3 X 50 interactive presentations and discussions			0%
2	Understand the concept of expanding a field	Presents evidence of the relationship between the degrees of expansion between related fields. Determine the external and internal description of the smallest subfield that contains a field and an element in its extension. Explains the relationship between the algebraic properties of an element in an expansion and the degree of expansion of the smallest subfield containing that element.		3 X 50 interactive presentations and discussions			0%
3	Understand the roots of polynomials in a field and its dividing fields	Shows the existence of an expansion field that contains all the roots of a polynomial over the field. Explains the relationship between two fields separating a polynomial		3 X 50 interactive presentations and discussions			0%
4	Understand the roots of polynomials in a field and its dividing fields	Shows the existence of an expansion field that contains all the roots of a polynomial over the field. Explains the relationship between two fields separating a polynomial		3 X 50 interactive presentations and discussions			0%

5	Understand the elements of Galois theory	Presents proof of the relationship between automorphism groups and the expansion of a field. Explain the relationship between rational function fields and symmetric rational function fields. Presents a proof of correspondence between a collection of extension subfields and a collection of automorphism subgroups on those extensions.		3 X 50 interactive presentations and discussions			0%
6	Understand the elements of Galois theory	Presents proof of the relationship between automorphism groups and the expansion of a field. Explain the relationship between rational function fields and symmetric rational function fields. Presents a proof of correspondence between a collection of extension subfields and a collection of automorphism subgroups on those extensions.		3 X 50 interactive presentations and discussions			0%
7	Understand the elements of Galois theory	Presents proof of the relationship between automorphism groups and the expansion of a field. Explain the relationship between rational function fields and symmetric rational function fields. Presents a proof of correspondence between a collection of extension subfields and a collection of automorphism subgroups on those extensions.		3 X 50 interactive presentations and discussions			0%
8	Understand the algebra of linear operators	Explains a collection of homomorphisms of vector spaces to form associative algebra. Shows the characteristics of regular linear operators on n-dimensional vector spaces		3 X 50 interactive presentations and discussions			0%

9	Understand the algebra of linear operators	Explains a collection of homomorphisms of vector spaces to form associative algebra. Shows the characteristics of regular linear operators on n-dimensional vector spaces		3 X 50 interactive presentations and discussions			0%
10	Understanding the roots of characteristics	Presents a proof of the relationship between the characteristic root of a linear operator and its minimal polynomial		3 X 50 interactive presentations and discussions			0%
11	Understand matrices over fields Understand triangular canonical form Understand canonical form of nilpotent linear operators Understand Jordan canonical form Understand rational canonical form	Shows the isomorphic relationship between the algebra of linear operators in a finite dimensional vector space and a matrix space. Shows sufficient conditions for a linear operator to have a triangular matrix representation. Presents a proof of the similarity characterization of two nilpotent linear operators. Shows sufficient conditions for a linear operator to have Jordan canonical form. Shows sufficient conditions for a linear operator to have a rational canonical form.		3 X 50 interactive presentations and discussions			0%
12	Understand matrices over fields Understand triangular canonical form Understand canonical form of nilpotent linear operators Understand Jordan canonical form Understand rational canonical form	Shows the isomorphic relationship between the algebra of linear operators in a finite dimensional vector space and a matrix space. Shows sufficient conditions for a linear operator to have a triangular matrix representation. Presents a proof of the similarity characterization of two nilpotent linear operators. Shows sufficient conditions for a linear operator to have Jordan canonical form. Shows sufficient conditions for a linear operator to have a rational canonical form.		3 X 50 interactive presentations and discussions			0%

13	Understand matrices over fields Understand triangular canonical form Understand canonical form of nilpotent linear operators Understand Jordan canonical form Understand rational canonical form	Shows the isomorphic relationship between the algebra of linear operators in a finite dimensional vector space and a matrix space. Shows sufficient conditions for a linear operator to have a triangular matrix representation. Presents a proof of the similarity characterization of two nilpotent linear operators. Shows sufficient conditions for a linear operator to have Jordan canonical form. Shows sufficient conditions for a linear operator to have a rational canonical form.		3 X 50 interactive presentations and discussions			0%
14	Understand matrices over fields Understand triangular canonical form Understand canonical form of nilpotent linear operators Understand Jordan canonical form Understand rational canonical form	Shows the isomorphic relationship between the algebra of linear operators in a finite dimensional vector space and a matrix space. Shows sufficient conditions for a linear operator to have a triangular matrix representation. Presents a proof of the similarity characterization of two nilpotent linear operators. Shows sufficient conditions for a linear operator to have Jordan canonical form. Shows sufficient conditions for a linear operator to have a rational canonical form.		3 X 50 interactive presentations and discussions			0%
15	Understand matrices over fields Understand triangular canonical form Understand canonical form of nilpotent linear operators Understand Jordan canonical form Understand rational canonical form	Shows the isomorphic relationship between the algebra of linear operators in a finite dimensional vector space and a matrix space. Shows sufficient conditions for a linear operator to have a triangular matrix representation. Presents a proof of the similarity characterization of two nilpotent linear operators. Shows sufficient conditions for a linear operator to have Jordan canonical form. Shows sufficient conditions for a linear operator to have a rational canonical form.		3 X 50 interactive presentations and discussions			0%

16							0%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
		0%

Notes

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.