	Universitas Negeri Surabaya **Faculty of Mathematics and Natural Sciences** **Bachelor of Mathematics Education Study Program**	**Document Code**

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Discrete mathematics	8420202004	Compulsory Study Program Subjects	**T=2**	**P=0**	**ECTS=3.18**	3	January 26, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model	**Case Studies**

Program Learning Outcomes (PLO)

PLO study program which is charged to the course

PLO-7	Apply basic mathematical principles to solve simple mathematical problems
PLO-12	Demonstrate mathematical knowledge and insight

Program Objectives (PO)

PO - 1	Able to demonstrate mathematical knowledge and insight relating to the rules of enumeration, permutation and combination.
PO - 2	Able to demonstrate mathematical knowledge and insight related to generating functions.
PO - 3	Able to demonstrate mathematical knowledge and insight related to recursive relations.
PO - 4	Able to demonstrate mathematical knowledge and insight related to the principles of inclusion and exclusion.

PLO-PO Matrix

P.O	PLO-7	PLO-12
PO-1		
PO-2		
PO-3		
PO-4		

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
PO-1																
PO-2																
PO-3																
PO-4																

Short Course Description	Examining the concept of basic rules in counting, permutations, combinations, generating functions, recursive relations, and the principle of inclusion-exclusion and applying them to solve daily problems through active learning using expository methods, question and answer, and giving assignments.

References

Main :

1. K.H. Rosen. 2011. Discrete Mathematics with Applications, 7th edition.New York: Mc GrawHill.
2. Budayasa, I. K. 2008. Matematika Diskret. Surabaya: Unesa University Press.

Supporters:

1. Mattson, Jr. 1993. Discrete Mathematics with Applications. Singapore: John Wiley&Sons, Inc.

Supporting lecturer	Prof. Drs. I Ketut Budayasa, Ph.D. Dr. Pradnyo Wijayanti, M.Pd. Dr. Budi Rahadjeng, S.Si., M.Si. Mukhtamilatus Sa'diyah, M.Pd.

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	1.1. Be able to explain the rules of multiplication and addition rules in counting. 2.2. Able to apply the rules of multiplication and addition in solving counting problems.	1. Explain the rules for multiplication and addition rules in counting. 2. Apply the rules of multiplication and addition in solving counting problems.	**Criteria:** Can apply the rules of multiplication and addition in solving counting problems. **Form of Assessment** : Participatory Activities, Practice/Performance	1. Group discussions to solve problems related to multiplication rules and addition rules. 2. Presentation and question and answer regarding solving problems related to multiplication rules and addition rules that have been worked out. 100 minutes	- -	**Material:** Basic Principles in Enumeration (Multiplication Rules and Addition Rules) **Library:** *Budayasa, IK 2008. Discrete Mathematics. Surabaya: Unesa University Press.*	0%
2	1.1. Be able to explain the concept of combination and permutation. 2.2. Able to apply the concept of combination and permutation in solving counting problems.	1.1. Explain the concept of combination and permutation. 2.2. Apply the concept of combination and permutation in counting problems.	**Criteria:** Students can solve combination and permutation problems using multiplication rules and addition rules. **Form of Assessment** : Participatory Activities, Practice/Performance	1. Group discussions to solve problems related to the concepts of combination and permutation. 2. Presentation and question and answer regarding solving problems related to the concepts of combination and permutation that have been worked on. 100 minutes	- -	**Material:** Combinations and Permutations **Literature:** *Budayasa, IK 2008. Discrete Mathematics. Surabaya: Unesa University Press.*	0%
3	1.1. Be able to explain the concept of combination and permutation. 2.2. Able to apply the concept of combination and permutation in solving counting problems.	1.1. Explain the concept of combination and permutation. 2.2. Apply the concept of combination and permutation in counting problems.	**Criteria:** Students can solve combination and permutation problems using multiplication rules and addition rules. **Form of Assessment** : Participatory Activities, Practice/Performance	1. Group discussions to solve problems related to the concepts of combination and permutation. 2. Presentation and question and answer regarding solving problems related to the concepts of combination and permutation that have been worked on. 100 minutes	- -	**Material:** Combinations and Permutations **Literature:** *Budayasa, IK 2008. Discrete Mathematics. Surabaya: Unesa University Press.*	0%

4	1.1. Be able to explain the concepts of binomial coefficients, multinomial coefficients, and the bird's nest principle. 2.2. Able to solve problems related to binomial coefficients, multinomial coefficients, and the 'Dove's Nest' principle.	1.1. Explain the concept of binomial coefficients, multi-nomial coefficients, and the 'Dove's Nest' principle. 2.2. Solve problems related to binomial coefficients, multi-nomial coefficients, and the 'Dove's Nest' principle.	**Criteria:** Can solve problems related to binomial coefficients, multi-nomial coefficients, and the 'Dove's Nest' principle. **Form of Assessment** : Participatory Activities	1. Group discussions to solve problems related to the concepts of binomial coefficients, multinomial coefficients, and the bird's nest principle. 2. Presentation and question and answer regarding solving problems related to the concepts of binomial coefficients, multinomial coefficients, and the bird's nest principle that have been worked on. 100		**Material:** Binomial coefficients, multi-nomial coefficients, and the 'Dove's Nest' principle **Library:** *Budayasa, IK 2008. Discrete Mathematics. Surabaya: Unesa University Press.*	0%
5	1.1. Be able to explain the concepts of binomial coefficients, multinomial coefficients, and the bird's nest principle. 2.2. Able to solve problems related to binomial coefficients, multinomial coefficients, and the 'Dove's Nest' principle.	1.1. Explain the concept of binomial coefficients, multi-nomial coefficients, and the 'Dove's Nest' principle. 2.2. Solve problems related to binomial coefficients, multi-nomial coefficients, and the 'Dove's Nest' principle.	**Criteria:** Can solve problems related to binomial coefficients, multi-nomial coefficients, and the 'Dove's Nest' principle. **Form of Assessment** : Participatory Activities	1. Group discussions to solve problems related to the concepts of binomial coefficients, multinomial coefficients, and the bird's nest principle. 2. Presentation and question and answer regarding solving problems related to the concepts of binomial coefficients, multinomial coefficients, and the bird's nest principle that have been worked on. 3. Case study: Given a problem applying the pigeon hole principle, students use the pigeon hole principle to solve it. 100		**Material:** Binomial coefficients, multi-nomial coefficients, and the 'Dove's Nest' principle **Library:** *Budayasa, IK 2008. Discrete Mathematics. Surabaya: Unesa University Press.*	0%

6	1.1. Be able to explain the concept of power series and the definition of ordinary and exponential generating functions. 2.2. Able to solve problems related to power series, ordinary generating functions, and exponentials.	1.1. Explain the concept of power series and define ordinary and exponential generating functions. 2.2. Solve problems related to power series, ordinary generating functions, and exponentials.	**Criteria:** Can solve problems related to power series, ordinary generating functions, and exponentials. **Form of Assessment** : Participatory Activities	Discussion and questions and answers. Do practice questions. 100		**Material:** Power series, ordinary generating functions, and exponentials **Reference:** *Budayasa, IK 2008. Discrete Mathematics. Surabaya: Unesa University Press.*	0%
7	1.1. Be able to explain the concept of generating functions for combinations. 2.2. Able to solve combination problems with generating functions.	1.1. Explain the concept of power series and define ordinary and exponential generating functions. 2.2. Solve problems related to power series, ordinary generating functions, and exponentials.	**Criteria:** Can solve problems related to power series, ordinary generating functions, and exponentials. **Form of Assessment** : Participatory Activities	Discussion and questions and answers. Do practice questions. 100		**Material:** Generator functions for combinations **References:** *Budayasa, IK 2008. Discrete Mathematics. Surabaya: Unesa University Press.*	0%
8				Written Test 100			0%
9	1.1. Be able to explain the concept of generating functions for permutations. 2.2. Able to solve permutation problems with generating functions.	1.1. Explain the concept of generating functions for permutations. 2.2. Solving permutation problems with generating functions.	**Criteria:** Can solve permutation problems with generating functions. **Form of Assessment** : Participatory Activities	Discussion and questions and answers. Exercises. 100		**Material:** Generating function for permutation. **References:** *Budayasa, IK 2008. Discrete Mathematics. Surabaya: Unesa University Press.*	0%
10	1.1. Be able to explain the concept of generating functions for permutations. 2.2. Able to solve permutation problems with generating functions.	1.1. Explain the concept of generating functions for permutations. 2.2. Solving permutation problems with generating functions.	**Criteria:** Can solve permutation problems with generating functions. **Form of Assessment** : Participatory Activities	Discussion and questions and answers. Exercises. 100		**Material:** Generating function for permutation. **References:** *Budayasa, IK 2008. Discrete Mathematics. Surabaya: Unesa University Press.*	0%
11	1.Be able to explain the general form of linear recursive relations. 2.Able to solve problems related to linear recursive relations.	1.1. Explain the general form of linear recursive relations. 2.2. Able to solve problems related to linear recursive relations.	**Form of Assessment** : Participatory Activities	Discussion and questions and answers Practice questions 100		**Material:** General form of linear recursive relations and solving recursive relations with characteristic roots. **References:** *Budayasa, IK 2008. Discrete Mathematics. Surabaya: Unesa University Press.*	0%

12	Able to solve recursive relation problems with generating functions.	Solving recursive relation problems with generating functions.	**Criteria:** Can solve recursive relation problems with generating functions. **Form of Assessment** : Participatory Activities	Discussion and questions and answers Practice questions 100		**Material:** Solving recursive relations with generating functions. **References:** *Budayasa, IK 2008. Discrete Mathematics. Surabaya: Unesa University Press.*	0%
13	Able to solve recursive relation problems with generating functions.	Solving recursive relation problems with generating functions.	**Criteria:** Can solve recursive relation problems with generating functions. **Form of Assessment** : Participatory Activities	Discussion and question and answer Case study: Given a recursive relation, students look for a solution. 100		**Material:** Solving recursive relations with generating functions. **References:** *Budayasa, IK 2008. Discrete Mathematics. Surabaya: Unesa University Press.*	0%
14	1.1. Be able to explain the general form of the inclusion-exclusion principle. 2.2. Able to solve problems related to the Inclusion-Exclusion Principle.	1.1. Explain the general form of the inclusion-exclusion principle. 2.2. Resolve problems related to the Inclusion-Exclusion Principle.	**Form of Assessment** : Participatory Activities	Discussion and questions and answers. Exercises. 100		**Material:** Inclusion-Exclusion Principles **Library:** *Budayasa, IK 2008. Discrete Mathematics. Surabaya: Unesa University Press.*	0%
15	1.1. Be able to explain the general form of the inclusion-exclusion principle. 2.2. Able to solve problems related to the Inclusion-Exclusion Principle.	1.1. Explain the general form of the inclusion-exclusion principle. 2.2. Resolve problems related to the Inclusion-Exclusion Principle.	**Form of Assessment** : Participatory Activities	Discussion and questions and answers. Exercises. 100		**Material:** Inclusion-Exclusion Principles **Library:** *Budayasa, IK 2008. Discrete Mathematics. Surabaya: Unesa University Press.*	0%
16	Final exams		**Form of Assessment** : Test			**Material:** Final Semester Exam **Literature:**	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.