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MODULE HANDBOOK

Module name	**Discrete Mathematics**
Module level	Undergraduate
Code	MII-1006
Courses (if applicable)	
Semester	Fall (Even)
Contact person	Drs. Sri Mulyana, M. Kom.
Lecturer	1. Drs. Retantyo Wardoyo, M. Sc.. Ph. D. 2. MHD. Reza M. Pulungan, S. Si., M. Sc., Ph. D. 3. Drs. Sri Mulyana, M. Kom.
Language	Bahasa Indonesia & English
Relation to curriculum	1. Undergraduate degree program, compulsory, 6th semester. 2. International undergraduate program, compulsory, 6th semester.
Type of teaching, contact hours	1. Undergraduate degree program: lectures, < 60 students, 2. International undergraduate program: lectures, < 30 students.
Workload	1. Lectures: 3 x 50 = 150 minutes per week. 2. Exercises and Assignments: 2 x 50 = 100 minutes per week. 3. Private study: 1 x 50 = 50 minutes per week.
Credit points	3 credit points (sks).
Requirements according to the Examination regulations	A student must have attended at least 75% of the lectures to sit in the exams.
Recommended prerequisites	Logic for Computer Science

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<td>Learning outcomes (course outcomes) and their corresponding PLOs</td>
<td>After completing this module, a student is expected to:
CO1. Students are able to explain several proving techniques, including deductive and inductive techniques, and how to apply them.
CO2. Students are able to explain concepts related to the basic structures of mathematics, including sets, sequences, sums, and relations (functions, equivalence relations, partial orders) and their applications.
CO3. Students are able to explain graph theory, properties of graphs, their categories and applications.
CO4. Students are able to explain the properties of integers and are able to understand the applications.
CO5. Students are able to explain sums, recurrences, asymptotic, techniques to solve them, and their applications.
CO6. Students are able to explain techniques, both basic and advanced, to do counting, together with its applications.
CO7. Students are able to explain the concepts of generating functions, its relations with counting and their applications.
CO8. Students are able to explain the fundamental concepts of algebra, including groups, rings and fields, together with their applications.

<table>
<tr><th colspan="2">PLO</th><th>CO1</th><th>CO2</th><th>CO3</th><th>CO4</th><th>CO5</th><th>CO6</th><th>CO7</th><th>CO8</th></tr>
<tr><td rowspan="5">Program Learning Outcome (PLO)</td><td>PLO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>PLO2</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>PLO3</td><td></td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>PLO4</td><td></td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>PLO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<td>Contents</td>
<td>1. Inductive proof: the principle of induction, strong induction, well-ordering principle.
2. Basic structures: sets, sequences, relations, functions, and matrices.
3. Equivalence and partial order relations: binary relations, image and inverse images, equivalent relations, partitions, partial orders, total orders, multiplication of relations, limitation of relations.
4. Directed graph: path, acyclic directed graph, topological sorting, parallel task scheduling, Dilworth's lemma.
5. Graph and tree: definition, types, isomorphism, handshaking lemma, connectivity, tree, spanning tree.
6. Introduction to number theory: division and modular arithmetic, integer representation and algorithms, prime numbers and greatest common divisor, congruence solving, congruence applications, cryptography.
7. Sum and product: closed form, approach and asymptotic, geometric sum and infinite geometric sum, integral method, addition doubles, the Stirling approach.
8. Recurrence: guess-and-verify, plug-and-chug, divide-and-conquer recurrence, linear recurrence, master method, Akra-Bazzi method.
9. Counting: basics of enumeration, the principle of pigeonhole, permutations and combinations, binomial coefficients and identities, permutations and generalized combination, permutation generation and combination, inclusion-exclusion, inclusion-exclusion application.</td>
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<tr><td></td><td>10. Generating function: ordinary generating functions, operations, Fibonacci sequences, enumeration with generating functions.
11. Algebra system: group, ring, field.</td></tr>
<tr><td>Study and examination requirements and forms of examination</td><td>The evaluation is done in 2 forms, namely:
1. Trial, either midterm or semester test,
2. Eight tasks, including individual,

Assessment is done using benchmark assessment, with the aim of measuring the level of student understanding related to the target and class rank.</td></tr>
<tr><td>Media employed</td><td>e-learning Platform (eLOK), LCD, whiteboard, and websites.</td></tr>
<tr><td>Assessments and Evaluation</td><td>
<table>
<tr><th>Type</th><th>Percentage</th><th>CO1</th><th>CO2</th><th>CO3</th><th>CO4</th><th>CO5</th><th>CO6</th><th>CO7</th><th>CO8</th></tr>
<tr><td>Task 1</td><td>5</td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Task 2</td><td>5</td><td></td><td>√</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Task 3</td><td>5</td><td></td><td></td><td>√</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Task 4</td><td>5</td><td></td><td></td><td></td><td>√</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Mid Test</td><td>30</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Task 5</td><td>5</td><td></td><td></td><td></td><td></td><td>√</td><td></td><td></td><td></td></tr>
<tr><td>Task 6</td><td>5</td><td></td><td></td><td></td><td></td><td></td><td>√</td><td></td><td></td></tr>
<tr><td>Task 7</td><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td><td>√</td><td></td></tr>
<tr><td>Task 8</td><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>√</td></tr>
<tr><td>Final test</td><td>30</td><td></td><td></td><td></td><td></td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Total</td><td>100</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td>Reading List</td><td>1. Kenneth H. Rosen, 2007, Discrete Mathematics and its Applications, 6th Edition, McGraw-Hill.
2. Thomas W. Judson, 2015, Abstract Algebra: Theory and Applications, 2015th Edition, Orthogonal Publishing L3C. http://abstract.ups.edu/download/aata-20150812.pdf
3. Eric Lehman, F. T. Leighton, and Albert R Meyer, 2017, Mathematics for Computer Science, Samurai Media Limited.</td></tr>
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