Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

Expected Implementation in Academic Year	AY2025-2026
Semester/Trimester/Others (specify approx. Start/End date)	Semester 2
Course Author * Faculty proposing/revising the course	Lim Kay Jin
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Course Title	Algebra I
Course Code	MH2220
Academic Units	3
Contact Hours	38
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	(MH1200 or CY1602) and MH1300
Co-requisites	
Pre-requisite to	
Mutually exclusive to	MH2200
Replacement course to	
Remarks (if any)	

Course Aims

This MAS course aims to introduce group theory that is essential for more advanced algebra courses and applications. The axiomatic concepts serve as a language to study concrete examples in broader sense and helps in developing logical thinking.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	State the definitions and fundamental results in group theory.
ILO 2	Provide, prove, identify or recognize various examples and non-examples of groups, subgroups, normal subgroups and quotient groups.
ILO 3	Manipulate group elements using generators and relations.
ILO 4	Present and interpret Cayley tables.
ILO 5	Present permutations in different forms and compute their orders and signatures.
ILO 6	Read and write simple and logically proofs based on axioms or fundamental results.
ILO 7	Analyze groups based on their orders and other properties.
ILO 8	Provide, prove and manipulate various examples of group homomorphism or isomorphism.
ILO 9	Compute and manipulate cosets of a subgroup in a group.
ILO 10	Construct the quotient group G/N given a group G and its normal subgroup N.
ILO 11	Provide, prove, identify or recognize various examples and non-examples of group actions.

Course Content

- Axioms of group and examples
- Cyclic groups, dihedral groups, symmetric groups, alternating groups, matrix groups, Group of automorphisms, Abelian groups
- Group homomorphisms and isomorphisms
- Group actions
- Subgroups, including centralizers, normalizers, stabilizers, kernels of homomorphisms
- Quotient groups
- Lagrange's Theorem
- Isomorphism Theorems
- Direct product, semidirect products
- Classification of finite abelian groups

Reading and References (if applicable)

D.S. Dummit, R.M. Foote, Abstract Algebra, third edition, John Wiley & Sons, Inc., Hoboken, NJ, 2004. ISBN-10 : 0471433349

NOTE: The above listing comprises the foundational readings for the course and more up-to-date relevant readings will be provided when they are available.

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Axioms of group and examples	1, 5	Textbook: 1.1, 1.2, 1.3, 1.4	In-person	Lecture & Wooclap
2	Properties of groups	1, 2, 3, 4, 7	Textbook: 1.1, 1.2, 1.3, 1.4	In-person	Lecture & Wooclap
3	Group homomorphisms and isomorphisms	1, 4, 8	Textbook: 1.6	In-person	Lecture & Wooclap
4	Subgroups, including centralizers, normalizers, stabilizers, kernels of homomorphisms	1, 2, 3, 9	Textbook: 2.1, 2.2, 2.3	In-person	Lecture & Wooclap
5	Cosets	1, 9	Textbook: 3.1	In-person	Lecture & Wooclap
6	Lagrange's Theorem	1, 9	Textbook: 3.1	In-person	Lecture & Wooclap
7	Normal subgroups and quotient groups	1, 2, 9, 10	Textbook: 3.3	In-person	Lecture & Wooclap
8	Isomorphism Theorems	1, 6, 8, 9	Textbook: 3.3	In-person	Lecture & Wooclap
9	Isomorphism Theorems	1, 6, 8, 9	Textbook: 3.3	In-person	Lecture & Wooclap
10	Direct product, semidirect product	1, 2, 3, 6	Textbook: 5.1, 5.5	In-person	Lecture & Wooclap
11	Classification of finite abelian groups	3, 6	Textbook: 5.2	In-person	Lecture & Wooclap

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
12	Group actions	3, 6, 11	Textbook: 1.7, 4.1	In-person	Lecture & Wooclap
13	The orbit-stabilizer theorem, Cauchy-Frobenius lemma	3, 6, 11	Textbook: 4.3	In-person	Lecture & Wooclap

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lectures	Interactive Lecture: The suggested learning and teaching approach consists of breaking the flow of the lectures by introducing exercises to be solved by the students in small groups during the lectures themselves. A typical pattern would be: the lecturer introduces a new concept, or a new proof, and then asks you to answer a question or solve a small exercise involving the new concept/proof. The lecturer then discusses the answer with you. If the newly introduced concept is understood well enough, the lecturer can then continue to build upon it, otherwise, further explanation is given. This also ensures that you have improved your knowledge in each of the classes that they are attending. This also encourages you to attend the classes, by being more active. In each lecture, there is a Wooclap session. Students are expected to take the initiative to discuss in groups but submit individual answers.
Tutorials	Problem solving: Develop competence in logical thinking and problem solving especially in abstract algebra

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Description of Assessment Component	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Test/Quiz(Short Answer Questions 1)	1, 2, 3, 4, 6, 7		20	Individual in-person test	Individual	Analytic	Relational
2	Continuous Assessment (CA): Test/Quiz(Short Answer Questions 2)	5, 8, 9, 10, 11		20	Individual in-person test	Individual	Analytic	Relational
3	Summative Assessment (EXAM): Final exam(Short Answer Questions)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11		55	Individual in-person final examination	Individual	Analytic	Relational
4	Continuous Assessment (CA): Class Participation(In-class activities during either lectures or tutorials. Best of 5 out of 10 sessions.)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11		5	In-class activities during either lectures or tutorials using Wooclap	Individual and Team	Analytic	Relational

Description of Assessment Components (if applicable)

Formative Feedback

You will receive formative feedback for your CA. It is done by commenting on the mistakes and misunderstanding that appeared in your CA. General feedback for your performance as part of the end of course review is done based on the final exam: the most common mistakes, as well as the questions that were best answered, are discussed in the report provided to all students.

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level
Curiosity	Advanced
Problem Solving	Advanced
Critical Thinking	Advanced
Embrace Challenge	Intermediate

Course Policy

Policy (Academic Integrity)

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values. As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

You are expected to attend all classes punctually and take all scheduled assignments and tests by due dates. You are expected to take responsibility to follow up with course notes, assignments and course related announcements. You are expected to participate in all discussions and activities.

Policy (Absenteeism)

Attendance at midterm tests is mandatory. Timetable clashes are not accepted as a valid excuse for absence — please plan your schedule accordingly. In the case of medical emergencies, you must provide a valid and verifiable medical certificate within the specified timeframe. Failure to comply with these requirements may result in a grade penalty or a zero for the missed assessment.

Policy (Others, if applicable)

Diversity and inclusion policy

Integrating a diverse set of experiences is important for a more comprehensive understanding of science.

It is our goal to create an inclusive and collaborative learning environment that supports a diversity of perspectives and learning experiences, and that honours your identities; including ethnicity, gender, socioeconomic status, sexual orientation, religion or ability.

To help accomplish this:

- If you are neuroatypical or neurodiverse, have dyslexia or ADHD (for example), or have a social anxiety disorder or social phobia;
- If you feel like your performance in the class is being impacted by your experiences outside of class;
- If something was said in class (by anyone, including the instructor) that made you feel uncomfortable;

Please speak to your teaching team, our school pastoral officer or a peer or senior (either in-person or via email) about how we can help facilitate your learning experience.

As a participant in course discussions, you should also strive to honour the diversity of your classmates. You can do this by: using preferred pronouns and names; being respectful of others opinions and actively making sure all voices are being heard; and refraining from the use of derogatory or demeaning speech or actions.

All members of the class are expected to adhere to the NTU anti-harassment policy. if you witness something that goes against this or have any other concerns, please speak to your instructors or a faculty member.

Appendix 1: Assessment Rubrics

Rubric for Mid-semester Quiz: Short Answer Questions 1 (20%)
Point-based marking

Rubric for Mid-semester Quiz: Short Answer Questions 2 (20%)
Point-based marking

Rubric for Class Participation: Wooclap (5%)
Marked using Wooclap

Rubric for Examination: Short Answer Questions (55%)
Point-based marking