NANYANG TECHNOLOGICAL UNIVERSITY

Teaching, Learning and Pedagogy Division

Reg. No. 200604393R

PROPOSED COURSE OUTLINE TEMPLATE FOR STUDENTS AT NTU

Academic Year	2018/2019	**Semester**	1
Course Coordinator	Troy Lee		
Course Code	MH1200		
Course Title	Linear Algebra 1		
Pre-requisites	none		
No of AUs	4		
Contact Hours	4 hours per week (3 hours lecture, 1 hour tutorial)		
Proposal Date	7/12/2017		

Course Aims

This is a core course for mathematics students and a suitable elective for engineering students. This course provides a grounding on vectors, matrices, and solving systems of linear equations that is fundamental for future mathematics courses and also many practical applications.

Intended Learning Outcomes (ILO)

By the end of this course, you (as a student) would be able to:

Vectors:

1. Do basic vector manipulation: addition, scalar multiplication, matrix-vector product
2. Compute dot products, and interpret in terms of length and angle
3. Visualize linear combinations of vectors in 2 and 3 dimensions

Solving systems of linear equations:

4. Apply the principle of Gaussian elimination to solve linear equations.
5. Identify the number of solutions to a system of linear equations in row echelon form.
6. Apply the column and row pictures of matrix multiplication as appropriate to solve problems.
7. Find the LU decomposition of a matrix.
8. Identify when a matrix is invertible and compute inverses in this case.

Determinants:

9. Compute determinants via Gaussian elimination.
10. Derive the cofactor and “big” formulas for the determinant.

Vector Spaces:

11. Determine if a given set is a vector space.
12. Apply the concepts of linear independence and span.
13. Find bases for the four fundamental subspaces associated to a matrix.
14. Derive the relationships between these four fundamental subspaces.

Orthogonality:

15. Find the projection of a vector onto a subspace.
16. Find the least squares solution to an inconsistent system of linear equations.

Course Content

The course begins by introducing vectors and matrices, and basic operations on them. We then move into the fundamental topic of solving system of linear equations and learn the Gaussian elimination algorithm, an idea that pervades the entire course. In the second half of the course we revisit these ideas in a more abstract way, learning about general vector spaces, linear independence, and the fundamental subspaces associated with a matrix. These ideas are then applied to finding the least squares solution to an inconsistent system of linear equations.

Assessment (includes both continuous and summative assessment)

Component	Course LO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/Individual	Assessment rubrics
1. Final Examination	All	A1-A4, B1-B4, C1	50%	Individual	Point-based marking (not rubrics based)
2. Midterm	1-8	A1-A4, B1-B4, C1	30%	Individual	Point-based marking (not rubrics based)
3. Quizzes (5)	All	A1-A4, B1-B4, C1	20%	Individual	Point-based marking (not rubrics based)
Total			100%		

Formative feedback

Feedback will be given to you through the continuous assessment quizzes given throughout the course and the weekly problem sets that are covered in tutorial.

Common mistakes on a quiz or in the midterm will be discussed in the provided solution sets.

Learning and Teaching approach

Approach	How does this approach support students in achieving the learning outcomes?
Examples and Explanation (Lecture & Tutorial)	Motivates the concepts in the learning objectives through examples. The general theory and principles are then explained. This also introduces more abstract mathematical reasoning.
Problem solving (Lecture & Tutorial)	Develops competence in solving a variety of problems and gaining familiarity with mathematical proofs.
Peer Instruction (Tutorial)	You will work together to gain experience in explaining concepts to others and presenting solutions.

Reading and References

Introduction to Linear Algebra, Gilbert Strang

Course Policies and Student Responsibilities

Absence due to medical or other reasons

If you are unable to attend a quiz or midterm due to a medical or other valid reason you should follow the SPMS guidelines for applying for short leave given here: http://www.ntu.edu.sg/Students/Undergraduate/AdminServices/Pages/Applyforshortleave.aspx

No make-up quizzes or exams will be given. If the absence is approved by SPMS then the quiz or exam will be exempted. In the case of a quiz, this means the 20% quiz score will be taken from the average of the remaining quizzes. In the case of the midterm, the 30% midterm weighting will be put on the final.

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. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office Location	Phone	Email
Troy Lee	SPMS-MAS-05-02	65921799	troylee@ntu.edu.sg

Planned Weekly Schedule

Week	Topic	Course LO	Readings/ Activities
1	Course info, introduction to vectors	1	Strang 1.1
2	Vector operations, dot product	2,3	Strang 1.2,1.3
3	Linear equations, Gaussian elimination	4,5	Strang 2.1, 2.2
4	Matrix view of elimination, matrix operations	6,7	Strang 2.3,2.4,2.7
5	LU decomposition, matrix inverse	7,8	Strang 2.6,2.5

6	Definition of determinants	9	Strang 5.1
7	Computing determinants	10	Strang 5.2
8	Finish determinants	10	Strang 5.3
9	Vector spaces, subspaces	11,12	Strang 3.1,3.2
10	Independence, basis, dimension	12	Strang 3.5
11	Dimension of 4 spaces, matrix rank	13,14	Strang 3.6,3.3
12	Orthogonality, projection	14,15	Strang 4.1,4.2
13	Least squares approximation	16	Strang 4.3