NANYANG TECHNOLOGICAL UNIVERSITY

Teaching, Learning and Pedagogy Division

Reg. No. 200604393R

Academic Year	2020/2021	**Semester**	2
Course Coordinator	Anders Gustavsson		
Course Code	CY1602		
Course Title	Mathematics II		
Pre-requisites	CY1601 Mathematics I		
No of AUs	4		
Contact Hours	TBL: 24 Hours Tutorial : 24 Hours		
Proposal Date	18 Jan 2021		

Course Aims

To equip the student with the subject knowledge, logical reasoning and communication skills required to independently and in teams, apply the concepts and methods of calculus and linear algebra, to science or engineering related problems.

Intended Learning Outcomes (ILO)

Upon successful completion of this course, students should be able to :

1. Independently process and interpret concepts and methodologies related to vector calculus, series and linear algebra, combine them and apply them to solve science or engineering related problems.
2. Critically assess the applicability of mathematical tools in the workplace.
3. Critically assess the validity of a mathematical argument involving concepts from the course content.
4. Present mathematical ideas logically and coherently at the appropriate level for the intended audience.
5. Work in teams on problems that require applications of the course content, and communicate the results verbally and in written form. These problems may also involve some programming in a suitable programming language, e.g. Python.
6. Identify the role of mathematics in other sciences, such as physics, chemistry, biology, or earth science.

Course Content

- Vector fields, parametric curves, line integrals. Green's theorem.
- Parametric surfaces, surface integrals. Stokes' and Gauss' theorems.
- Sequences and series, power series, Taylor's formula.
- Linear systems, matrix algebra, determinants.
- Abstract vector spaces, subspaces, linear independence, eigenvalues and eigenvectors, diagonalization

- Inner products, orthogonal systems, Gram-Schmidt process, Fourier series.
- Applications of the above theory. Applications may include topics such as Vector calculus in electrostatics, Cryptography, Markov chains, Google PageRank, Regression, Principal Component Analysis, Classification/discrimination, and Fourier Methods for PDEs.
- Applications of mathematics in other sciences, such as physics, chemistry, biology, or earth science.

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	1, 2, 3, 4	a,f	50%	Individual	See Appendix 1.
2. Continuous Assessment 1 (CA1): Individual and Team Readiness assessments (iRA / tRA).	1,2, 3, 4, 5	a,f,i	25% (IRA 15%, TRA 10%)	Individual and Team	
3.CA2: Application Exercises	2, 3, 4, 5, 6	a,f,i	10%	Team	
4. CA3: Peer Evaluation	4, 5	f,i,j	15%	Individual	See Appendix 3
Total			100%		

Formative feedback

For the final exam, comments on solutions and common errors are given to students after the exams are marked.
For CA1 and CA2 students are able to submit questions that will be answered in class. Immediate feedback on their answers and common errors are also given in class.
For CA3, students can give anonymous comments to their team members.

Learning and Teaching approach

Approach	How does this approach support students in achieving the learning outcomes?

Team Based Learning	*For a typical iRA/tRA, the student is asked to determine whether some given statements are true or false. The anwers can't be directly found in the reading material but has to be logically deduced from the given information using the tools and concepts from the reading matireal. On the individual level, this relates directly to LOs 1–3 and for the team based assessment, LO 4.* *Application Exercises require the student teams to work together to solve problems reaching beyond the examples found in readings or tutorials, and will often involve some simple computer programming. This relates in particular to LOs 2--5.*

Reading and References

Main text: Provided lecture notes.
Supplementary: Stewart – Calculus (any edition), Anton – Elementary Linear Algebra (any edtion).

Course Policies and Student Responsibilities

(1) General

You are expected to complete all assigned pre-class readings and activities, attend all seminar 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 for seminar sessions they have missed. You are expected to participate in all seminar discussions and activities.

(2) Absenteeism

TBL requires you to be in class to contribute to team work. In-class activities make up a significant portion of your course grade. Absence from class without a valid reason will affect your overall course grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. There will be no make-up opportunities for in-class activities.

If you miss a seminar session, you must inform your team members and me via email (include email address) prior to the start of the class. Students who miss in-class activities with valid reasons will be exempted from that activity in score calculations. Students who miss class activities without a valid reason will get a zero score for that session of absence.

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
Anders Gustavsson	SPMS-MAS-04-10	65137450	erik@ntu.edu.sg

Planned Weekly Schedule

Week	Topic	Course LO	Readings/ Activities
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1	Introduction		
2	Vector fields, Parametric curves, line integrals. Green's theorem.	1–5	IRA / TRA
3	Parametric surfaces, surface integrals. Stokes' and Gauss' theorems.	1–5	IRA / TRA
4	Linear systems and matrix algebra.	1–5	AE
5	Matrix algebra, determinants, Eigenvalues/Eigenvectors	1–5	AE
6	Vector spaces, linear combinations, linear independence, basis and dimension.	1–5	IRA / TRA
7	Inner product spaces.	1–5	Revision
8	Best approximation, curve fitting, Fourier series.	1–5	AE
9	Diagonalization, quadratic	1–5	AE

	forms and applications.		
10	Series, convergence tests		Revision
11	Power series and Taylor series.		IRA/TRA
12	PDEs and Fourier methods.		AE
13	Revision		Revision

Appendix 1: Assessment Criteria for final exam

Criteria	Standards		
	Fail standard	**Pass standard**	**High standard**
Method of approach (LOs 1--3)	Using methods that are irrelevant or do not apply to the given problem. Invoking theorems whose conditions are not satisfied.	Using relevant arguments or theorems that help solve the problem. Invoking theorems whose conditions are satisfied.	Using arguments and theorems in logically consistent ways to solve nonstandard problems.
Validity of reasoning (LO 3)	The student's reasoning is logically invalid.	The student's reasoning is logically valid.	The student's reasoning is logically valid and effective.
Clarity of argument (LO 4)	The student's reasoning is poorly explained or not explained at all.	The student's reasoning is clear, but may contain some gaps.	The student's reasoning is clear, precise, with no or insignificant gaps.

Appendix 2: Assessment Criteria for iRA/tRA and AE.

iRA / tRAs and AEs are assessed by multiple choice questions.

Appendix 3: Assessment Criteria for Peer Review.

The peer review is conducted by the students themselves. The following criteria are recommended:

Criteria	Standards		
	Fail standard	**Pass standard**	**High standard**
Punctuality	The team member arrives late without a valid reason to TBL sessions on more than one or two occasions.	Except for one or two occasions, the team member arrives on time to TBL sessions, or has a valid reason to be late.	The team member arrives on time to every TBL session, or has a valid reason not be late.
Valuable contribution	The team members provides no or little valuable input at TBL sessions.	The team member provides some valuable contributions at TBL sessions.	The team member provides creative and useful ideas at TBL sessions.
Facilitates discussion	The team member pays little attention to the rest of the team.	The team member pays attention to ideas from other team members.	The team member recognizes the strengths of individual team members and incorporates the best ideas for the benefit of the team.