NANYANG TECHNOLOGICAL UNIVERSITY

Teaching, Learning and Pedagogy Division

Reg. No. 200604393R

COURSE CONTENT FOR MH2100

Academic Year	AY1920	**Semester**	1
Course Coordinator	Gary Greaves		
Course Code	MH2100		
Course Title	Calculus III		
Pre-requisites	MH1101 Calculus II OR MH1805 Calculus		
No of AUs	4		
Contact Hours	4 hours per week (3 hours of lecture, 1 hour of tutorial)		
Proposal Date	04 June 2019		

Course Aims

Calculus III is a core Mathematics course that extends concepts and techniques developed in Calculus I and Calculus II to the case of functions of several real variables. In other words, we try to do the same things as in Calculus I and II, but in higher dimensions. In this course, we shall discuss the notions of limits, continuity, derivatives and integrals of real-valued and vector-valued functions of many variables. Most of the time, extending these familiar notions from one to several variables requires some degree of ingenuity, and we are going to have to spice up the material from Calculus I and II with a little bit of geometry and linear algebra. Techniques learned in Calculus III are essential for financial analysts, engineers, and for further study in mathematics.

Intended Learning Outcomes (ILO)

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

1. parametrise curves and their tangents;
2. approximate and optimise multivariate functions;
3. apply the chain rule to multivariate functions;
4. find volumes of geometrical objects in higher dimensions;
5. parametrise surfaces and their tangent planes;
6. recognise when it is appropriate to use cylindrical and spherical coordinates;
7. determine the div and curl of a vector field and recognise the physical interpretations of these quantities;
8. apply Stokes' theorem and its specialisations to simplify relevant problems;
9. apply multivariate calculus to real-world problems.

Course Content

Parametric equations, polar coordinates. Vector-valued functions, calculus of vector-valued functions. Functions of more than one variable, limits, continuity, partial derivatives, differentiability and total differential, chain rule, directional derivatives, gradients, Lagrange multipliers. Double integrals, area of a surface, triple integrals. Line integrals, Green's Theorem, surface integrals, Gauss' divergence theorem, Stokes' Theorem.

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, 5, 6, 7, 8, 9	MAS PLO A1, A2, B4, C1	60%	Individual	N/A
2. Continuous Assessment 1 (CA1): Midterm	1,2	MAS PLO A1, A2, C1	20%	Individual	N/A
3. CA2: Midterm	2,3,4,5,6	MAS PLO A1, A2, C1	20%	Individual	N/A
4. Total			100%		

Formative feedback

Component 2 and 3: formative feedback is written in the students' midterm scripts, which are returned to the students. Students will also receive formative feedback for all learning outcomes (including LO 7-9 tested in the final exam) during weekly tutorial classes from Week 2-Week 13.

Learning and Teaching approach

Approach	How does this approach support students in achieving the learning outcomes?
Derivation and demonstration	Helps students understand the motivation behind mathematical notions and ideas. Presents systematic ways to solve problems.
Problem solving	Develops competence in solving problems related to multivariate calculus.
Peer Instruction	Develops communication skills and strengthens mathematical skill.

Reading and References

James Stewart*, Calculus (8th edition)*
ISBN-10: 1285740629, ISBN-13: 978-1285740621

Course Policies and Student Responsibilities

Absence due to medical or other reasons

If you are sick and unable to attend a midterm you must:

1. Send an email to the instructor regarding the absence.
2. Submit the original Medical Certificate* to an administrator.

*The Medical Certificate mentioned above should be issued in Singapore by a medical practitioner registered with the Singapore Medical Association.

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
Gary Greaves	MAS-05-03	6513 8652	gary@ntu.edu.sg

Planned Weekly Schedule

Week	Topic	Course LO	Readings/ Activities
1	Parametric curves and tangent lines	1	10.1 (Curves Defined by Parametric Equations) 10.2 (Calculus with Parametric Curves)
2	Limits, continuity, and partial derivatives	2	14.1 (Functions of Several Variables), 14.2 (Limits and Continuity), and 14.3 (Partial Derivatives)
3	Partial derivatives and the classification of extreme points	2	Section 14.7 (Maximum and Minimum Values)
4	Tangent spaces and differentiability	5	Section 14.4 (Tangent Planes and Linear Approximations)

5	The chain rule and directional derivatives	3	Section 14.5 (The Chain Rule), 14.6 (Directional Derivatives and the Gradient Vector)
6	Lagrange multipliers	2	14.8 (Lagrange Multipliers)
7	Double integrals	4	15.1 (Double Integrals over Rectangles), 15.2 (Double Integrals over General Regions), 15.3 (Double Integrals in Polar Coordinates)
8	Multiple integrals and substitution	4, 6	15.6 (Triple Integrals), 15.7 (Triple Integrals in Cylindrical Coordinates), 15.8 (Triple Integrals in Spherical Coordinates), 15.9 (Change of Variables in Multiple Integrals)
9	Vector fields and line integrals	7	16.1 (Vector Fields), 16.2 (Line Integrals), 16.3 (The Fundamental Theorem for Line Integrals), and 16.5 (Curl and Divergence)
10	Green's theorem and surface integrals	7, 8	16.4 (Green's Theorem), 16.6 (Parametric Surfaces and Their Areas), and 16.7 (Surface Integrals)
11	Stokes' theorem	8	16.8 (Stokes' Theorem)
12	The divergence theorem	8	16.9 (The Divergence Theorem)
13	Summary	7,8	