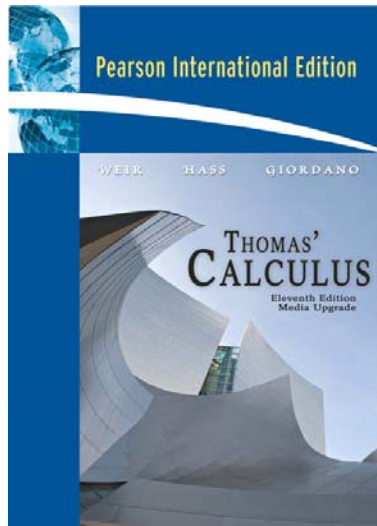


ZCA 110/4 (for Group B)
Calculus and Linear Algebra
Semester I, Academic year 08/09
[7 JULAI 2008 - 5 JULAI 2009]



Lecturer: Yoon Tiem Leong (for ZCA 110 Group B)




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Course Meeting Times

- 1) Monday, DKM, 11.00 am-11.50 am
- 2) Tuesday, DKA, 10.00 am-10.50am
- 3) Thursday, DKT, 13.00 pm-13.50 pm (extra hour), 14.00 pm -14.50 pm
- 4) Friday, DKS 10.00 am-10.50 am

Course Description

This is a Kursus Asas offered by the School of Physics. Students who take this course cannot simultaneously take MAA101/4 and MAA 111/4 because these courses overlap with ZCA 110. This course will be conducted in two separate groups (group A and group B). A student will belong to either one of these two groups. The two classes

will be handled concurrently by two different lecturers, namely Yoon Tiem Leong (i.e. me lah, ) for ZCA 110B and Prof. Rosy Teh (for ZCA 110A). Generally ZCA 110 is taken by most first year students in the school of physics. This course serves the purpose to prepare the basic foundation for any science students (particularly physics students) who would need this very important basic mathematics in their future undertaking of any

discipline of study. The course will be conducted in English. However, students can answer in either Bahasa or English in the final exam. Since this is a 4-unit course, as a rough guide, students have to spend about 4 hours for revision per week for this course. In other words, if you spend about 4 hours per week to practice the exercises it would be suffice to pass the course. Of course, if a student wants to score excellently he/she is required to walk an extra mile by spending more time than suggested for practicing the exercises.

Course Duration: 7 JULAI 2008 - 5 JULAI 2009 (14 weeks, excluding holidays)

Course Prerequisites:

Despite no formal prerequisites (prasyarat kursus) for this course, students are assumed to have been familiar with some basic mathematics at STPM or Matrikulasi level, such as simple differentiation, integration, trigonometry, basic algebra, geometry, and of course arithmetic of addition, subtraction, division and multiplication. Students who have a good foundation in the pre-U level mathematics as mentioned would definitely have an advantage. For those who don't, or have forgotten their mathematical foundation, working hard (and smart) consistently throughout the course will almost sure to compensate for the lack of strong foundation.

In addition, since this course will be conducted in English, students of course must also able to understand, to read and to write in English. It's a pity that some students fail to follow the course fully due to their poor command of English (such undesirable situation happens every year!).

Consultation hours

There is no specific timeslots allocated for consultation with Yoon Tiem Leong. You can come to see him in his office anytime as long as he is free to entertain you. However, in order to avoid inconveniences students are advised to call up (ext 3674) or email him (tlyoon@usm.my) before rushing into his office. His door is always open to you.

In addition, the tutors who assist in this course will also be asked to prepare two hours per week for consultation. Check out which tutorial group you belong to and who your tutor is. Proceed to consult them on problems in ZCA110 during the time specified (their timetables for consultation can be obtained from Moodle webpage for the course).

General Comments

- Calculus and linear algebra are the two very basic mathematical tools for anyone who wishes to study any branch of scientific discipline.
- As most mathematical calculation involves integration, differentiation, algebraic solutions to simultaneous equations etc., calculus and linear algebra are almost an indispensable survival skill a student must master in order to perform any basic mathematical calculation. Just like a building worker would not be able to built

any lasting building if he lacks the basic knowledge of, say, tightening a screw or knocking a nail, a science student lacking proficiency in calculus and linear algebra shall be seriously hindered when he/she is given the task of performing a serious investigation (either experimentally, theoretically or numerically) of any phenomena that necessarily involves mathematics of some kind. Having said that, ZCA 110 is not a particularly difficult subject. I would say it's "sup sup shui" (Cantonese, meaning "no sweat") as long as you keep an attitude to study and practice it consistently throughout the course.

- Calculus is tightly related to geometry, hence the geometrical interpretation of calculus makes it easily visualised, hence less abstract. Most concepts discussed in the calculus of ZCA 110 have been actually studied in the STPM or Matrikulasi syllabus. In ZCA 110 we extend the syllabus further to investigate more diversified kinds of functions (e.g. hyperbolic functions, inverse trigonometric functions etc.). In addition we shall also investigate the theoretical roots of some 'mysterious' formulae that were used but rarely explained in the pre-U level, such as $\frac{d}{dx}(\cos x) = -\sin x$. To explain this formula we need to go back to the basic idea of *limit* which is one of the most abstract ideas in calculus. Besides being a very interesting topic, the idea of limit may pose some challenge to the students who are new to it. Other than the concept of limit, the calculus syllabus also necessitates many problem-solving and calculations involving, e.g. integration, differentiation and graphing of many types of functions. Needless to say, practice is the only way (unless you are exceptionally brilliant) to make your study of ZCA 110 a perfect.

Textbooks

Both groups (A and B) will adopt the same text books. These include:

- **Schaum's Outline of Theory and Problems of Matrices SI (Metric) Edition** by Frank Ayres, McGraw-Hill (1974).
- **Thomas' Calculus**, 11th edition, by G.B. Thomas, Pearson international edition.

These are the text book you **MUST** have in order to follow the lecture. GET Both by all means!!!

Additional reference:

- **Elementary linear algebra**, 8th edition, by Howard Anton, Publisher: Wiley. This book will not be used explicitly. However it is listed here as an extra reference for those who are keen to know more about linear algebra.
- **Calculus, Schaum's outlines Series**, fourth edition, by Frank Ayres Jr. and Elliot Mendelson, McGraw-Hill 2000 edition. This book is an excellent book for the purpose of practicing more advanced exercises. In addition, it will also be explicitly used when covering topics involving series.
- **Linear Algebra, Schaum's outline series, by Seymour Lipschutz**. This book gives many solved problems as examples. Good for exercise.

It is strongly advised that students should not be contented with the lecture material supplied by the lecturers alone. They should **STUDY** these suggested texts and try out the exercises on a consistent manner throughout the semester. You gonna prepare to think in an intellectual manner in order to comprehend the essential concepts and

ways of performing calculation I wish to convey in this course. So please exercise your initiatives to think independently and critically.

On the other hand, for people who are expecting to make only mechanical memorisation yet can pass with flying colour (just like what you did during the pre-U years), please be prepared for disappointment. There is a high risk that you shall flop the course if you study mathematics via memorisation and don't practice enough on the exercises suggested. You are also be reminded that based on the track record of previous years, around 40%-50% of the students sitting thus course score a C- or worse.

Moodle

Every student must register themselves for the course ZCA 110B in electronic portal Moodle at <http://elearn.usm.my/fizik/>. Course-related material and notices will be uploaded there (e.g. tutorial questions, latest coursework grades, etc.)

Assessment

Coursework makes up 30% of the final grade of ZCA 110, while final exam 70%. (Final grade = 100 marks.)

Coursework assessment (10 + 10 + 10 = 30 marks): Two tests, each carry 10 marks, will be arranged during the semester. Students who miss the test for whatever reason must present proof (e.g. medical certificate or formal letter from the concerned authority) so that the lecturer can do something about their coursework grades. If the absence is deemed one without acceptable reasons, the candidate will get no mark for that particular test. Submission of tutorial questions constitutes 1/3 of coursework assessment (i.e. 10 marks).

TUTORIAL (continuous assessment)	10 marks	To be selected randomly.
TEST 1 (50 min)	10 marks	ALGEBRA LINEAR (10.00 – 10.50, 1 Ogos, Friday, at Dewan Peperiksaan)
TEST 2 (50 min)	10 marks	KALKULUS (10.00 – 10.50, 19 September, Friday, at Dewan Peperiksaan)

Tutorial classes

For the Calculus part, tutorial session is scheduled to take place during the Thursday afternoon slot. Attendance will be taken for the tutorial session. Students will not be sitting in separate tutorial classes. The tutorial session will be conducted in the lecture hall and handled by the lecturer himself.

Tutorial questions will be uploaded onto the web on a weekly basis (generally on Friday). Students are expected to attempt these questions and bring them for discussion during tutorial session on Thursday. In the tutorial class we will be discussing tutorial questions and exercises or doing Q&A. No new lecture material will be covered during the tutorial session. Students will also be expected to show some degree of proactiveness during the tutorial session such as asking questions or participate in discussion.

A number of students selected randomly will be invited (an alternative expression for “forced”) to submit their solutions for grading during every tutorial session. Those who fail to produce solutions for submission shall face possible penalty in terms of grade degradation.

ZCA 110 B Lecture Plan (Linear algebra part)
(week 1 – 3)

SELF-READING INITIATIVE

Text book (for linear algebra): Matrices by Frank Ayres, Schaum's Outline series

The table below lists the detailed topics from Ayres and the corresponding dates these topics will be covered.

In this self-reading initiative, students have to prepare and study the topics selected from chapters 1,2,3,4,5,6,8,9,10 themselves before coming to the class. Under this assumption, the lecturer will only conduct very brief introduction to these topics (say 10-15 minutes). After the brief introduction, students will begin attempting problems (which are made known to the students on or before the class) DURING the rest of the lecture hour. The lecturer will be walking around the class to assist students attempting the problems assigned. In the following session (i.e. the next class to come), the lecturer will discuss the problem sets attempted by students in the previous session in a more detailed manner. Randomly selected students will be asked to pass up the solutions for grading.

This initiative is a bold attempt to provoke self-study pro-activeness in our fellow first year students who are used to the chronic habit of spoon-feeding. Ideally, if this initiative works out, all students will make preparation for the pre-scheduled topics before coming to the classes, in which they will be forced to attempt questions without going through any formal lecture on these topics. Hence, students will have to understand the contents of these topics by doing the reading and studying for themselves before going to classes, failing which will result in their failure to submit the solutions when asked to do so. Such initiative hopes to promote an active form of learning, (although somewhat forcefully) in which student themselves shoulder a major portion of responsibility in the process of acquiring knowledge. In comparison, learning through lectures (which is the most conventional way teaching is done) is a relatively passive mode of learning.

Schedule for the first three weeks, covering all topics in linear algebra.**

Week	Date	Activity
1. Isnin, 07/07/08 -Sabtu, 12/07/08	7/7/08, Monday, 11 am -11.50 am	Briefing. No lecture.
	8/7/08, Tuesday, 10 am-10.50 am.	Brief lecture on Chapter 1 (Matrices): Equal matrices. Sum of matrices. Product of matrices. Chapter 2 (Some types of matrices): Triangular matrices. Scalar matrices. Diagonal matrices. The Identity Matrix. Transpose of a matrix. Symmetric matrices. Skew-symmetric matrices. Conjugate of a matrix. Hermitian matrices. Skew-Hermitian matrices. Direct sums. Problem sets covering Chapter 1, 2 will be uploaded to the webpage before the next class. Print hardcopy. Problem set for Chapter 3 and Chapter 4 will be uploaded to the webpage before the next class. Print hardcopy.

		Students are reminded to prepare for Chapter 3 and Chapter 4 for the next class.
	10/7/08, Thursday, 1 pm-1.50pm.	<p>Very brief lecture (10-15 minutes).</p> <p>The problem set hard-copy of Chapter 3, 4, will be distributed during the class.</p> <p>Students will attempt the problem set covering: Chapter 3 (Determinant of a square matrix): Determinants of orders 2 and 3. Properties of determinants. First minors and cofactors. Chapter 4 (Evaluation of determinants): Procedure for evaluating determinants.</p>
	10/7/08, Thursday, 2 pm-2.50pm.	<p>Discussion of solutions to the problems from the previous session (Chapter 1, 2, 3, 4).</p> <p>Problem set for Chapter 5 and Chapter 6 will be uploaded to the webpage before the next session. Print hardcopy.</p>
	11/7/08, Friday, 10 am-11.50am.	<p>Discussion of solutions to the problems from the previous session (Chapter 1, 2, 3, 4).</p> <p>The problem set hard-copy of Chapter 5, 6 will be distributed during the class.</p> <p>Students are reminded to prepare for Chapter 5 and Chapter 6 for the next class.</p>
2. Isnin, 14/07/08 -Sabtu, 19/07/08	14/7/08, Monday, 11.00 am-11.50 am	<p>Randomly selected students will be asked to submit the solutions of previous session (i.e. Chapter 1, 2, 3, 4).</p> <p>Very brief lecture (10 – 15 minutes).</p> <p>Students will attempt the problem set covering: Chapter 5 (Equivalence): Rank of a matrix. Non-singular and singular matrices. Elementary transformations. Inverse of an elementary transformation. Equivalent matrices. Row equivalence. Elementary matrices. Inverse of a product of elementary matrices. Chapter 6 (The adjoint of a square matrix): The adjoint.</p>
	15/7/08, Tuesday, 10.00 am-11.50 am	<p>Randomly selected students will be asked to submit the solutions of previous session (i.e. Chapter 5, 6).</p> <p>Discussion of solutions to the problems from the previous session.</p> <p>Problem set for Chapter 8 and Chapter 9 will be uploaded to the webpage before the next class. Print hardcopy.</p>

	17/7/08, Thursday, 1.00 pm-1.50 pm	<p>Very brief lecture (10-15 minutes).</p> <p>Students will attempt the problem set covering: Chapter 8 (The inverse of a matrix): The inverse. Inverse from the adjoint. Inverse from elementary matrices. Chapter 9 (Linear dependence of vectors and forms): Vectors. Linear dependence of vectors. Basic theorems. A linear Form.</p> <p>The problem set hard-copy of Chapter 8, 9 will be distributed during the class.</p>
	17/7/08, Thursday, 2.00 pm-2.50 pm	<p>Discussion of solutions to the problems from the previous session.</p> <p>Problem set for Chapter 10 will be uploaded to the webpage before the next class. Print hardcopy.</p> <p>Students are reminded to prepare for Chapter 10 for the next class.</p>
	18/7/08, Friday, 10.00 am-10.50 am	<p>Randomly selected students will be asked to submit the solutions of previous session (i.e. Chapter 8, 9).</p> <p>The problem set hard-copy of Chapter 10 will be distributed during the class.</p> <p>Students will attempt the problem set covering: Chapter 10 (Linear equations): Definitions. Solution using a matrix. Fundamental theorems. Non-homogeneous equations. Homogeneous equations.</p>
3. Isnin, 21/07/08 -Sabtu, 26/07/08	21/7/08, Monday, 11am-11.50 am.	<p>Randomly selected students will be asked to submit the solutions of previous session (i.e. Chapter 10).</p> <p>Discussion of solutions to the problems from the previous session.</p> <p>Problem set for Chapter 11, 12 will be uploaded to the webpage before the next class. Print hardcopy.</p>
	22/7/08, Tuesday, 10am-10.50 am	<p>The problem set hard-copy of Chapter 10 will be distributed during the class.</p> <p>Full-length lecture on the following topic: Chapter 11 (Vector spaces): Vector spaces. Subspaces. Basis and dimension. Bases and coordinates.</p>
	24/7/08, Thursday, 1 pm-1.50 am	<p>Full-length lecture on the following topic: Chapter 12 (Linear transformations): Definition. Basic theorems. Change of basis.</p>
	24/7/08, Thursday, 2 pm-2.50 am	<p>Tutorial session.</p>

	25/7/08, Friday, 10 am-10.50 am	Tutorial session.
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**NOTE: The schedule is tentative and subjected to change.

ZCA 110 B Lecture Plan (Calculus part)**
(week 4 – end of semester)

Text book (for Calculus): Thomas' Calculus, by George B Thomas, revised by M.D. Wier, J. Hass and F. R. Giodano. 11th edition.

Week	Date	Topic to cover (full-length lecture)
4	Isnin, 28/07/08 -Sabtu, 02/08/08	1.3 Functions and Their Graphs
		1.4 Identifying Functions; Mathematical Models
		1.5 Combining Functions; Shifting and Scaling Graphs
		1.6 Trigonometric Functions
		2.1 Rates of Change and Limits
5	Isnin, 04/08/08 - Sabtu, 09/08/08	2.2 Calculating Limits Using the Limits Laws
		2.3 The Precise Definition of a Limit
		2.4 One-Sided Limits and Limits at Infinity
		2.5 Infinite Limits and Vertical Asymptotes
		2.6 Continuity
6	Isnin, 11/08/08 - Sabtu, 16/08/08	2.7 Tangents and Derivatives
		3.1 The Derivative as a Function
		3.2 Differentiation Rules
		3.3 The Derivative as a Rate of Change
		3.4 Derivatives of Trigonometric Functions
7	Ahad, 17/08/08 - Ahad, 24/08/08	3.5 The Chain Rule and Parametric Equations
		3.6 Implicit Differentiation
		4.1 Extreme Values of Functions
		Cuti Pertengahan Semester

8	Isnin, 25/08/08 Sabtu, 30/08/08	-	<p>4.2 The Mean Value Theorem</p> <p>4.3 Monotonic Functions and The First Derivative Test</p> <p>4.4 Concavity and Curve Sketching</p> <p>4.5 Applied Optimization Problems</p> <p>4.6 Indeterminate Forms and L' Hopital's Rule</p> <p>4.8 Antiderivatives</p>
9	Isnin, 02/09/08 Sabtu, 06/09/08	-	<p>5.1 Estimating with Finite Sums</p> <p>5.2 Sigma Notation and Limits of Finite Sums</p> <p>5.3 The Definite Integral</p> <p>5.4 The Fundamental Theorem of Calculus</p> <p>5.5 Indefinite Integrals and the Substitution Rule</p> <p>5.6 Substitution and Area Between Curves</p>
10	Isnin, 08/09/08 Sabtu, 13/09/08	-	<p>6.3 Lengths of Plane Curves</p> <p>7.1 Inverse Functions and Their Derivatives</p> <p>7.2 Natural Logarithms</p> <p>7.3 The Exponential Function</p> <p>7.4 a^x and $\log a_x$</p> <p>7.5 Exponential Growth and Decay</p>
11	Isnin, 15/09/08 Sabtu, 20/09/08	-	<p>7.7 Inverse Trigonometric Functions</p> <p>7.8 Hyperbolic Functions</p> <p>8.1 Basic Integration Formulas</p> <p>8.2 Integration by Parts</p> <p>8.3 Integration of Rational Functions by Partial Fractions</p> <p>8.4 Trigonometric Integrals</p>
12	Isnin, 22/09/08 Sabtu, 27/09/08	-	<p>8.5 Trigonometric Substitutions</p> <p>8.6 Integral Tables and Computer Algebra Systems</p> <p>8.8 Improper Integrals</p> <p>11.1 Sequences</p>

			11.2 Infinite Series 11.3 The Integral Test
13	Ahad, 28/09/08 Ahad, 05/10/08	-	Cuti Khas
14	Isnin, 06/10/08 Sabtu, 11/10/08	-	11.4 Comparison Tests 11.5 The Ratio and Root Tests 11.6 Alternating Series, Absolute and Conditional Convergence 11.7 Power Series 11.8 Taylor and Maclaurin Series 11.9 Convergence of Taylor Series; Error Estimates
15	Isnin, 13/10/08 Rabu, 18/10/08	-	11.10 Applications of Power Series 11.11 Fourier Series
16	Isnin, 20/10/08 Rabu, 25/10/08	-	Spared
17	Ahad, 26/10/08 Ahad, 02/11/08	-	Minggu Mengulangkaji
18	Isnin, 03/10/08 Jumaat, 08/11/08	-] Peperiksaan
19	Isnin, 10/11/08 Jumaat, 15/11/08	-	
20	Isnin, 17/11/08 Jumaat, 22/11/08	-	
21 - 24	Ahad, 23/11/08 Ahad, 21/12/08	-	CUTI DI ANTARA SEMESTER

**NOTE: The schedule is tentative and subjected to change.