ZCA 110/4 (for Class B)

Calculus and Linear Algebra

ZCA 110 B Lecture Plan		
Week	Date	Topic to cover
1	Isnin, 09/07/07 - Sabtu, 14/07/07	-
2	Isnin, 16/07/07 - Sabtu, 21/07/07	Identity Matrix, Special Square Matrices, Inverse of a Matrix, Transpose of a Matrix, Symmetric Matrices, Conjugate of a Matrix, Hermitian Matrices, Direct Sums.
3	Isnin, 23/07/07 - Sabtu, 28/07/07	Determinants of orders 2 and 3, Properties of Determinants, Minors and Cofactors, Adjoint of a Square Matrix, Evaluation of Determinant, The Inverse of a Matrix, Elementary Transformation, Solution using a Matrix, Fundamental Theorems
4	Isnin, 30/07/07 - Sabtu, 04/08/07	Homogeneous Equations, Vector Spaces, Subspace, Basis and Dimension, Linear Transformation, Basic Theorems, Change of Basis
5	Isnin, 06/08/07 - Sabtu, 11/08/07	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 2.2 Calculating Limits Using the Limits Laws
6	Isnin, 13/08/07 - Sabtu, 18/08/07	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
		2.7 Tangents and Derivatives 3.1 The Derivative as a Function
7	Isnin, 20/08/07 - Sabtu, 25/08/07	3.2 Differentiation Rules 3.3 The Derivative as a Rate of Change
		3.4 Derivatives of Trigonometric Functions 3.5 The Chain Rule and Parametric Equations
		3.6 Implicit Differentiation 4.1 Extreme Values of Functions
8	Isnin, 27/08/07 - Sabtu, 01/09/07	4.2 The Mean Value Theorem 4.3 Monotonic Functions and The First Derivative Test
		4.4 Concavity and Curve Sketching 4.5 Applied Optimization Problems

			4.6 Indeterminate Forms and L' Hopital's Rule
			4.8 Antiderivatives
9	Isnin, 03/09/07 Sabtu, 08/09/07	-	5.1 Estimating with Finite Sums
			5.2 Sigma Notation and Limits of Finite Sums
			5.3 The Definite Integral
			5.4 The Fundamental Theorem of Calculus
			5.5 Indefinite Integrals and the Substitution Rule
			5.6 Substitution and Area Between Curves
10	Isnin, 10/09/07 Sabtu, 15/09/07	-	6.3 Lengths of Plane Curves
			7.1 Inverse Functions and Their Derivatives
			7.2 Natural Logarithms
			7.3 The Exponential Function
			7.4 a^x and log a_x
			7.5 Exponential Growth and Decay
11	Isnin, 17/09/07 Sabtu, 22/09/07	-	7.7 Inverse Trigonometric Functions
			7.8 Hyperbolic Functions
			8.1 Basic Integration Formulas
			8.2 Integration by Parts
			8.3 Integration of Rational Functions by Partial Fractions
			8.4 Trigonometric Integrals
12	Isnin, 24/09/07 Sabtu, 29/09/07	-	8.5 Trigonometric Substitutions
			8.6 Integral Tables and Computer Algebra Systems
			8.8 Improper Integrals
			11.1 Sequences
			11.2 Infinite Series
			11.3 The Integral Test
13	Isnin, 01/10/07 Sabtu, 06/10/07	-	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

14	Isnin, 08/10/07 Rabu, 10/10/07	-	11.10 Applications of Power Series 11.11 Fourier Series
15 – 16	Khamis,11/10/07 Ahad, 28/10/07	-	Revision Week

Lecturer: <u>Yoon Tiem Leong</u>

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<u>Course Meeting Times</u>

Lectures: Three lectures / week, 50mins / lecture

1) Monday, SK1, 11.00-11.50 am

2) Tuesday, SK4, 10.00-10.50am

3) Thursday, DKT, 13.00-14.50 pm (2 hours)

4) Friday, DKV,10.00-10.50 am

Course Description

- This is a Kursus Teras offered by school of physics. Students who take this course cannot simultaneously take MAA101/4 and MAA 111/4 because these courses overlap with ZCA 110.
- There will be two separate classes for ZCA 110 (A and B). The two classes will be handled concurrently by two different lecturers, namely Yoon Tiem Leong (i.e. me lah,   ) for ZCA 110B and Dr. Rosy Teh (for ZCA 110A).
- The coursework assessment (worth 30%) for the two classes will be conducted separately. However, both will sit for the same final exam.
- Both classes will be using the same set of lecture notes and tutorial questions.
- 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 units 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 want to score excellently he/she is required to walk an extra mile by spending more time than suggested for practicing the exercises.

Course Duration

- This course is offered in the first semester for science students in the USM -- a 14-week term at USM that runs from 9 July 2007 until 10 Oct 2007 (14 weeks).

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, working hard (and smart) consistently throughout the course will almost sure to compensate for the the lack of strong foundation.
- In addition, since this course will be conducted in English, students of course must also able to to understand, to read and to write in English.

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.

General Comments

- Calculus and linear algebra are the two very basic mathematical tools for anyone who wish 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 students lacking proficiency in calculus and linear algebra shall be seriously hindered when he/she is given the task of performing a serous 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 trigo 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 $d/dx\,(\cos x) = -\sin x$. 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 necessitate 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 classes (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. This book will not be used explicitly. However it is listed here as an extra reference for those who are keen to know more.

Additional references:
- **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. an 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.

Students are strongly urged to get either one of these books. 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.

Assessment (applied only to ZCA 110(B))

Coursework makes up 30% of the final grade of ZCA 110, while final exam 70%.

There will be no tests (as opposed to ZCA 110 class A). Students will be required to participate in weekly short, simple quizzes (10-15 mins). The rationale for a weekly short, simple quiz is to motivate students to consistently study in pace with the materials covered along the semester. These short quizzes shall be simple and not burdening for those who have revised the recent material covered. In addition to the weekly quiz, students are also expected to submit some online assignments electronically (roughly two short assignments per week) via the ZCA 110B page in Moodle. The grades and solutions of the assignments and weekly quiz shall be uploaded to the ZCA110B Moodle page for public perusal. The weekly quiz and electronic assignment shall add up to contribute 30% of the final grade.

The arrangement of the coursework assessment is intentionally designed in such a manner that students will be able to score with relative ease (the 'carrot') as long as they do revise their homework on a consistent manner (the 'stick'). Such is my strategy to encourage (some may say, force) students to learn.

Tutorial

- Tutorial session is scheduled to take place during every 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.
- A short quiz of 15 minutes will be conducted during the weekly tutorial class.
- After the quizzes, we will be discussing tutorial questions and exercises or doing Q&A instead. 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.
- Remember, now you can't wait passively for your tutors to mark the tutorial questions for you anymore. Hence you have to be proactive to take initiatives to discuss whatever questions you have with the lecturer during tutorial sessions, or you may consult the assigned tutors during their respective <u>consultation hours</u>. To encourage active learning, you are also expected to make active discussions with your fellow course mates. It would be an excellent practice if students could form study groups among themselves.