Faculty of Science

Department of Pure and Applied Mathematics

Applied Mathematics 2A

STUDY GUIDE 2017

1 Introduction

A central theme of Applied Mathematics is mathematical modelling, which is the representation of problems from science, engineering, business and industry as mathematical models. Differential equations arise when we construct mathematical models concerned with the relationships between changing quantities and the rate at which these quantities change. Consider the following example. In classical mechanics, the position of a particle is given by a vector function $r : \mathbb{R} \to \mathbb{R}^3$, where

$$r = r(t) = \begin{pmatrix} x(t) \\ y(t) \\ z(t) \end{pmatrix}.$$

The first derivative

$$v(t) = \frac{d}{dt} r(t)$$

of the position vector is called the velocity vector and the second derivative

$$a(t) = \frac{d^2}{dt^2} r(t)$$

is called the acceleration vector. Newtons second law of motion states that the acceleration of the particle, produced by some net force F acting on it, is directly proportional to the magnitude of the net force and inversely proportional to the mass m of the particle, that is

$$m = \frac{d^2}{dt^2} r(t) = F(t, r(t)). \qquad (1)$$

The goal is to solve equation (1), i.e. given $\frac{d^2 r}{dt^2}$ and F, find the unknown function $r(t)$.

2 Lectures

The attendance of lectures is compulsory!

Day	Time	Timetable Code	Group 1 Venue	Group 2 Venue
Tuesday	08:00-08:45	G1	B Les 100	B Les 103
Wednesday	08:00-08:45	G2	B Les 100	B Les 103
Thursday	17:10-17:55	G3	B Les 100	C Les 201

Lecturer:	Dr MV Visaya (Course co-ordinator)
Office:	B Ring 526
Telephone:	+27-11-559-2332
Email:	mvvisaya@uj.ac.za
Consultation:	Wednesdays, 09:00-10:30

Lecturer:	Mr JM Homann
Office:	B Ring 534A
Telephone:	+27-11-559-2790
Email:	jmhomann@uj.ac.za
Consultation:	Thursdays, 15:30-17:00

Secretary	Mrs S Geldenhuys
Office	B-Ring 527
Telephone	+27-11-559-2067
Email	sgeldenhuys@uj.ac.za
Availability	Monday – Friday, 08:00 – 12:00

Consultation. If a student wishes to consult the lecturer *outside* the specified consultation times, then they are requested to make an appointment via email at least 24 hours in advance of the proposed appointment time.

To avoid confusion, students are asked to adhere to the following guidelines:

- The subject line must include a
  - prefix with the module code APM02A2, and a
  - one line description of the problem.
- The body of the email should make reference to the section of work with which the student has a problem and the student should give a detailed description of the problem they are having. This helps resolve the problem expediently during the consultation appointment.

3 Tutorials

This module has one schedule tutorial period per week, on Wednesdays from 15:30 until 17:05, during which tutors will be available to help students with any problems they might be experiencing with the coursework and/or any other problems concerning the study of Differential Equations. A student is assigned a Group (1, 2, or 3). Tutorial tests will be announced ahead of the tutorial day. *The attendance of tutorials is compulsory!* One tutorial test will take place at the end of each month and the average of these tests will comprise a tutorial mark (TM). A tutor is available outside of the tutorial periods at the Mathematics Learning Centre (MLC), located in Mathematics Passage 2 (C Ring 5).

4 Assessment

No consultation will take place on the day of a test or exam and no consultation will take place on the day before a test or exam!

Assessment	**Date**	**Time**	**Venue**
Semester Test 1 (ST_1)	15 March 2017	15:30-17:05	D1 Lab 308
Semester Test 2 (ST_2)	19 April 2017	15:30-17:05	D1 Lab 308
Sick Tests 1 and 2	26 April 2017	15:30-17:05	TBA
Final Exam	12 June 2017	08:30-11:30	TBA

A Final Period Mark (FPM) will be calculated at the end of the semester for each student and it will be determined by the student's performance in both the semester tests and the tutorial tests. The mark is calculated as:

$$FPM = 45\% \times (ST_1 + ST_2) + 10\% \times TM.$$

The student needs an FPM of 40% or greater in order to obtain entrance to the final examination. The student will obtain an exam mark (EM) upon attending and writing the final exam and the student requires an EM of 40% or greater in order to pass the final exam. The final mark (FM) for the student is calculated as:

$$FM = 50\% \times EM + 50\% \times FPM.$$

Pass Requirements: Credit for this module requires both a *minimum final mark of* 50% and a *minimum exam mark of* 40%. A student is admitted to the final exam by obtaining a *minimum final period mark of* 40%).

Civility. Students will be treated as adults and be shown the same respect that they show the lecturer and their fellow students. Students are therefore asked to not disrupt lectures by talking during the lecture, eating in the venue, or arriving late for the lecture.

4.1 Missed assessment opportunities

In the event of illness or due to a contingency such as the sudden death of a family member, the student will be exempted from the scheduled assessment opportunities and may apply for a substitute assessment opportunity.

A student may not apply for the substitute assessment opportunity due to poor results in or failure of the scheduled assessment opportunities!

Substitute semester test / Sick Test The application for a substitute or aegrotat assessment opportunity is done by

1. Applying in writing using the approved application form, which is available from Blackboard, the ISSC website or the relevant Faculties.

2. Section 2 of the application form MUST be completed by the medical practitioner (doctor) consulted in the case of an illness. If this is not done, the application will be deemed invalid and the student may not take part in the special assessment opportunity.

3. If all documentation has been completed, the application forms must be submitted to Mrs. Geldenhuys or the lecturer, and it must be submitted within one week (7 days) of the relevant semester test that was missed.

Failure to comply to this procedure will invalidate any application for a special assessment opportunity. The venue and time slot of the substitute semester test will be communicated to students during lectures and will be posted online and on the notice boardsoutside B Ring 5.

Supplementary, Substitute, or Aegrotat (SSA) Exam: In the event of illness or death of an immediate family member and the student was unable to sit for the exam, then the student may apply to write a substitute or aegrotat examination. The student must apply for the special exam *with the relevant Faculty, and not the department.* The relevant application form can be obtained from the relevant Faculty, and must be given back *not later than seven*

days after the original examination to the relevant Faculty with the appropriate accompanying documentation.

Under very special circumstances, the student may be granted a special examination if they fail the original examination—a student cannot apply for this special examination.

5 Module resources

5.1 Online

Blackboard This module can be found on Blackboard as

17APM2A10: 17APM02A2 - INTRODUCTION TO DIFFERENTIAL EQUATIONS.

Website `http://issc.uj.ac.za/appliedmaths/apm2A`

Both contain the same important information and course materials however Blackboard will be frequently used.

5.2 Notes

This module follows the following notes:

Trench, William F., "Elementary Differential Equations" (2013), *Faculty Authored Books.* Book 8. `http://digitalcommons.trinity.edu/mono/8`

These notes may be freely downloaded from the above URL or on Blackboard.

Recommended additional book (any edition will suffice - various editions have various authors, but the main author for each edition is Zill):
Zill, D.G., (2016), Differential Equations with Boundary-Value Problems, 9 ed., Boston: Cengage Learning.

5.3 Information dissemination : Blackboard

General information and information pertaining to this particular module at the department will be conveyed to students either verbally, in print or electronically. Verbal dissemination occurs during lectures. Information released in print will be available on the notice boards outside the division's entrance at B-Ring 5. Electronic release of information will be achieved via Blackboard.

PLEASE MAKE SURE TO ALWAYS READ ANNOUNCEMENTS IN BLACKBOARD. It will be the responsibility of the student, and not the lecturer, to make sure that they know where information pertaining to this module will be released and to read it on their own.

In any matter of dispute, ignorance, whether negligent or wilful, of information verbally given in class or published on Blackboard or the ISSC website, will not be used as an excuse for work not being completed or an assesment opportunity not being attended and will carry no weight in substantiating why the work had not been completed or why the assessment opportunity was not attended.

5.4 Grievance procedure

Any academic complaints should first be reported to the lecturer of the module. Should the proposed solution to the problem not be to the satisfaction of the student, they may then approach the Head of Department. The Head will decide if the complaint has any merit and if applicable, propose an alternative solution.

Should the student still feel grieved, they have the right to consult progressively higher up the hierarchy of the Faculty with the Vice Dean and then the Executive Dean if necessary. The relevant Executive Dean will be the final arbiter regarding the 'student's complaints pertaining to academic programmes.

Thereafter, should the complaint remain unresolved based on procedural grounds that could lead to a case of procedural unfairness (with particular reference to the University's Academic Regulations), the matter may be referred to the Registrar.

If the student does not want to deal with the academic staff directly, he/she may instead report the complaint to the appropriate representative of the SRC.

The student should avoid reporting his/her complaint to several people at the same time.