

ENGMA 101: **Engineering Mathematics 1** (3 units)

ENGMA 101 A: M - F, 0730 – 0900, F114

ENGMA 101 B: M - F, 0900 – 1030, F114

Some sessions may be held at CTC-219.

Instructor: Luisito L. Agustin

lagustin@ateneo.edu

http://www.geocities.com/lui_agustin

consultation hours: Monday, 12:30 - 16:30, F312/F311

or by appointment

1. Course Description

This course aims to equip students with the necessary knowledge in differential equations as applied to engineering problems. The topics include ordinary differential equations of the first order; linear differential equation with constant coefficients; simultaneous linear differential equations

Prerequisite: MA 22

2. Course Objectives

In this course students must learn how to solve ordinary differential equations. More specifically students must learn how to

- * solve separable first order ordinary differential equations (ODEs)
- * use integrating factors to solve first order ODEs
- * use ODEs to answer some questions about some electric circuits
- * use direction fields to solve some first order ODEs graphically/geometrically
- * use the Euler Method and Improved Euler Method to solve first and second order ODEs numerically
- * use power series to solve some ODEs
- * obtain solutions to Legendre's Equation
- * use the Frobenius Method to solve some ODEs
- * obtain solutions to Bessel's Equation
- * compute Laplace Transforms and inverse Laplace Transforms
- * use Laplace Transforms to solve ODEs
- * use Laplace Transforms to solve systems of ODEs

3. Textbook

[Kreyszig]

Erwin Kreyszig: *Advanced Engineering Mathematics*, 8th ed, 1999.

4. Course Outline and Timeframe

ENGMA 101 (Ordinary Differential Equations)

Introduction: Basic Concepts and Ideas (sec 1.1)

First Order Differential Equations

Separable Equations (sec 1.3)

Exact Differential Equations and Integrating Factors (sec 1.5)

Linear Differential Equations (sec 1.6)

Modeling: Electric Circuits (sec 1.7)

Direction Fields (sec 1.2)

Numerical Methods (sec 19.1)

Euler Method

Improved Euler Method

[First Exam]

Linear Second Order Differential Equations

Homogeneous Equations (sec 2.1, 2.2, 2.3)

Differential Operators (sec 2.4)

Nonhomogeneous Equations (sec 2.8)

Solution by Undetermined Coefficients (sec 2.9)

Numerical Methods for Higher Order Equations(sec 19.3)

Euler Method

Improved Euler Method

Modeling of Electric Circuits (sec 2.12)

[Second Exam]

Series Solutions of Differential Equations

Theory of the Power Series Method (sec 4.1, 4.2)

Legendre's Equation (sec 4.3)

Frobenius Method (sec 4.4)

Bessel's Equation (sec 4.5)

[Third Exam]

Laplace Transforms

Definitions and Basic Properties (sec 5.1)

Transforms of Derivatives and Integrals (sec 5.2)

Unit Step Function and Dirac's Delta Function (sec 5.3)

Partial Fractions (sec 5.6)

Systems of Differential Equations (sec 5.7)

[Fourth Exam]

ENGMA 101 Timetable, Summer 2004

	Monday	Tuesday	Wednesday	Thursday	Friday
Apr			14 Introduction (1.1)	15 Separable Differential Equations (1.3) Homework: # 6,12,14,16,18 p. 18	16 Exact Differential Equations (1.5) Homework: # 13,14,15,16,18 p. 32
	19 Linear Differential Equations (1.6) Homework: # 16,18,19,20,22 p. 39	20 Direction Fields (1.2) Euler Method (19.1) Homework: # 12,14, p. 13 # 1,2,4, p. 951	21 Modelling: Electric Circuits (1.7) Homework: # 3,4,5,16,19 p. 47-48	22 Improved Euler Method (19.1) Homework: # 6,7,8,9,10 p. 951	23 First Exam
	26 Homogeneous Linear Second Order ODEs (2.1,2.2,2.3) Homework: # 14,15,16,19,22 p. 80-81	27 Differential Operators (2.4) Homework: # 6,8,9,10,12 p. 83	28 Nonhomogeneous Equations: Solution by Undetermined Coefficients (2.8, 2.9) Homework: # 15,16,18,20,22 p. 108	29 Euler Method Applied to Second Order Equations (19.3) Homework: use Euler Method to solve the initial value problems in # 15,16,18,20,22 p. 108	30 Improved Euler Method Applied to Second Order Equations (19.3) Homework: use Improved Euler Method to solve the initial value problems in # 15,16,18,20,22 p. 108
May	3 Modelling of Electric Circuits (2.12) Homework: # 4,8,10,12,14 p. 122	4 Second Exam	5 Intro to the Power Series Method (4.1) Homework: # 2,4,6,8,10 p. 198	6 Theory of the Power Series Method (4.2) Homework: # 2,4,6,8,10 p. 204	7 Legendre's Equation (4.3) Homework: # 2,3,4,6,7 p. 209
	10 ENGMA 101 Holiday	11 Frobenius Method (4.4) Homework: # 2,4,6,8,10 p. 216	12 Frobenius Method (4.4) Homework: # 11,12,13,14,15 p. 216	13 Bessel's Equation (4.5) Homework: # 2,4,6,8,10 p. 226	14 Third Exam
	17 Basic Properties of Laplace Transforms (5.1) Homework: # 12,18,30,34,38 p. 257	18 Transforms of Derivatives and Integrals (5.2) Homework: # 2,3,4,6,8 p. 264	19 Unit Step Function and Dirac's Delta Function (5.3) Homework: # 22,26,30,34,36 p. 273-274	20 Partial Fractions (5.6) Homework: # 2,4,8,10,12 p. 289	21 Systems of Differential Equations (5.7) Homework: # 2,4,6,8,10 p. 294-295
	24 Systems of Differential Equations (5.7) Homework: # 12,13,14,19,20 p. 295	25 Fourth Exam			

Adjustments to the timetable will be made as needed.

5. Course Requirements

There will be four exams and regular homework. The ability to present homework in class is a requirement for one to receive credit for homework done. Detailed policies are in sec. 7.

5.1. Exams

Four exams will be given, as indicated in the course outline and timetable. The coverage of an exam will mainly be material that has been covered before the exam, but which has not been covered by a previous exam. However, it is understood that skills needed in an earlier exam may again be required in a succeeding exam.

All exams shall be “open notes, open books” exams.

Each exam shall consist of five items, with each item graded over 10 points regardless of its difficulty. The exam grade shall be twice the number of points earned.

There is no comprehensive final exam. Exemptions are available for each exam.

5.2. Homework and Recitation

Homework for each class day is specified in the timetable. Each exercise assigned as homework is worth 2 points regardless of the difficulty.

Recitation is incorporated into homework as a requirement. One may claim credit for homework only if he is fully capable of presenting and discussing the said homework in class. Credit for homework is claimed thru homework accomplishment reports as will be described later.

Bonus points may be earned in relation to homework that has been done correctly. Demerits will be given for inaccurate claims regarding homework.

6. Grading System

The basic class standing (BCS) is computed as

$$BCS = 0.90 E + 0.10 H$$

where

E is the average exam grade, and

H is the homework and recitation grade computed as

$$H = 100 * (\text{points earned}) / (\text{points possible}).$$

The class standing (CS) is computed as

$$CS = BCS + B - D,$$

where

B is the number of bonus points earned (details later), and

D is the number of accumulated demerits (details later).

The final grade (FG) will be determined from the class standing (CS) as follows:

FG =	F	if $CS < 50$,
	D	if $50 \leq CS < 60$,
	C	if $60 \leq CS < 69$,
	C+	if $69 \leq CS < 77$,
	B	if $77 \leq CS < 86$,
	B+	if $86 \leq CS < 92$,
	A	if $92 \leq CS$.

Your instructor has the prerogative of giving a higher grade than that determined from the class standing.

Bonus points are points added directly to your class standing. These points are given in relation to exercises assigned as homework. Detailed policies are in sec. 7.

Demerits are points deducted from your class standing for offenses against the conduct of the course. These offenses include, but are not limited to:

- * submitting inaccurate homework accomplishment reports
- * failure to discuss homework for which credit has been claimed
- * disrupting class discussion
- * doing work unrelated to ENGMA 101 during class time
- * use of cellphones during class time, cellphones ringing during class time
- * arriving late for an exam and/or disturbing others during an exam
- * refusal to participate in class activities
- * insisting on entering the classroom despite being late

One demerit is given for the first time an offense is committed. Successive offenses of the same nature shall be awarded two demerits, three demerits, and so on.

7. Class Policies

7.1. Exams

All exams must be accomplished using blue or black ink. Only the front of each sheet of paper should be used. No credit shall be given for anything written at the back nor for anything not written in ink.

Only the following paper may be used in exams:

- * white intermediate pad paper
- * white short bond paper
- * white long bond paper
- * yellow pad paper.

Students taking exams are required to bring 20 sheets of paper, and two pens. Students who do not have these will not be allowed to take the exam.

All exams shall be "open books, open notes" exams, except for make-up exams.

Students may and should bring calculators to exams. Students who do not bring calculators to exams forfeit the right to use them. Students may not pass calculators among themselves during exams. Students who do so shall be asked to submit their papers immediately.

Make up exams shall be taken with closed books and notes, regardless of the nature of the regular exam. Exemptions to this rule are possible only in extreme circumstances, and subject to the discretion of your instructor.

Answers to exam questions must be arranged in sequence and exam papers stapled together on the upper left hand side when they are submitted. 20 points shall be deducted from the exam grade if answers are not arranged in sequence. 20 points shall be deducted from the exam grade if the exam papers submitted are not stapled together on the upper left hand side. The exam grade shall be 0 if these deductions result in a negative score.

Each exam will have the same weight in the final grade. No exam will be canceled in computing the final grade.

7.2. Exemptions from Exams

A student shall be exempted from the first exam and given a grade of 100 for the exam if the student meets ALL of the following conditions on the day of the exam:

- * must have no cuts
- * must have no demerits for any offense whatsoever
- * must have a homework standing of at least 80
- * must have earned at least 5 bonus points

A student shall be exempted from the second exam and given a grade of 100 for the exam if the student meets ALL of the following conditions on the day of the exam:

- * must have no cuts
- * must have no demerits for any offense whatsoever
- * must have a homework standing of at least 80
- * must have earned at least 8 bonus points, with at least 5 bonus points earned after the first exam
- * must have a grade of at least 60 for the first exam

A student shall be exempted from the third exam and given a grade of 100 for the exam if the student meets ALL of the following conditions on the day of the exam:

- * must have at most 1 cut
- * must have no demerits for any offense whatsoever
- * must have a homework standing of at least 80
- * must have earned at least 11 bonus points, with at least 5 bonus points earned after the second exam
- * must have an average grade of at least 60 for the past exams

A student shall be exempted from the fourth exam and given a grade of 100 for the exam if the student meets ALL of the following conditions on the day of the exam:

- * must have at most 1 cut
- * must have no demerits for any offense whatsoever
- * must have a homework standing of at least 80
- * must have earned at least 14 bonus points, with at least 5 bonus points earned after the third exam
- * must have an average grade of at least 60 for the past exams

7.3. Homework

The fundamental rule in claiming credit for homework should be:

CLAIM CREDIT ONLY FOR WORK YOU HAVE REALLY DONE.

The homework accomplishment report form in sec. 9 of this syllabus shall be used for claiming credit for homework assigned. Printed, photocopied, and handwritten versions of the form are all acceptable. The paper used shall be one whole sheet of any of the following:

- * white intermediate pad paper
- * white short bond paper
- * white long bond paper
- * yellow pad paper.

Only blue or black ink may be used.

Homework accomplishment reports are due when they are called for in class. Only those physically present in class may submit homework accomplishment reports. Late reports will not be accepted.

Students claiming credit for any assigned exercise must be able to produce on demand their answers to the exercise, including any and all scratch paper used in working on that exercise.

A student may claim full credit for an assigned exercise if he has completed the homework and would be able to present all details of his work in class if called upon to do so. It is the student's responsibility to ensure that all instructions for a given exercise have been complied with.

A student may claim half credit for an assigned exercise if he has not completed the exercise, but has done a significant amount of work on the exercise, and would be able to present all details of his work in class if called upon to do so, as well as justify his claim that a significant amount of work has been done. Typically, a claim for half credit for an exercise is valid if a student can present much of the work called for, and could actually discuss what work remains to be done for the exercise to be completed or if a student can discuss in detail various nontrivial attempts to do the exercise, and can defend his claim that these attempts were nontrivial.

Merely starting an exercise or merely deciding that an exercise is too difficult does NOT entitle anyone to claim half credit for the exercise.

The penalty for an inaccurate homework accomplishment report on a given day shall be a 0 for all exercises assigned for that day, and demerits.

Full or half credit claimed for homework is NOT valid under circumstances similar to the following, among others:

- * a student can only present photocopies of accomplished homework for which credit is claimed (except for those who have submitted printed answers for possible bonus points)
- * a student can only present copies --whether photocopied or hand copied-- of someone else's homework but claims credit for it
- * a student is unable to discuss in class what he claims to be his homework
- * a student hesitates a lot and wastes a lot of time in trying to discuss in class what he claims to be his homework
- * a student has been copying homework from someone else a few minutes before class, and then claims credit for it

Students called to discuss their work, must be able to justify all details of homework they claim credit for. Inability to do so shall be penalized with a zero for homework, along with demerits.

The accuracy of homework accomplishment reports shall be verified more thoroughly for those who have previously submitted inaccurate reports, those who have demerits, and those who have cuts. The more demerits and cuts one has, the more thoroughly he should expect the accuracy of his reports to be checked.

7.4. Bonus Points

Bonus points are points added directly to the class standing.

Bonus points are given to those who submit correct answers to exercises assigned as homework, provided certain conditions are met.

Students may submit answers individually, or in groups of at most four. Answers must be printed --NOT HANDWRITTEN-- on short white bond paper, and must not have any part handwritten, nor have any erasures. The names of those submitting the exercise must be clearly printed at the start of the exercise. Each exercise submitted must be started on a new sheet of paper. If several sheets of paper are required, these must all be stapled together. The exercise must have been submitted by 11 a.m. of the school day prior to the day for which the exercise was assigned; Saturdays, Sundays, and holidays shall not count as school days. Submitted answers that do not meet all these conditions will not be evaluated.

Only students with at most 2 cuts may earn bonus points. Students with more than 3 cuts forfeit any and all bonus points already earned.

No information will be given as to whether answers have already been submitted for a given exercise.

Submitted answers are evaluated only after the corresponding classes for which they have been assigned. No feedback regarding their correctness should be expected before the day for which they were assigned.

If an exercise was submitted by a group, anyone in the group may be asked to defend the submitted answer. Failure to defend the answer by any member of the group shall be penalized with disqualification of the submitted answer, demerits for each member of the group, and disqualification of all members of the group from earning any more bonus points for the rest of the semester.

Answers that have been submitted for a given exercise shall be evaluated in the order they were submitted. Bonus points will be awarded for the first answer, if any, that meets ALL of the following conditions:

- * the answer must be correct, and must have no noticeable errors of whatever nature (whether logical, grammatical, typographical, etc.); solutions and computations must be sufficiently detailed
- * all those who submitted the answer must have no cuts on the day the exercise was assigned for
- * all those who submitted the answer must have had at most two cuts on the day the exercise was assigned for
- * all those who submitted the answer must have claimed credit for it in the corresponding homework accomplishment report

Two bonus points will be given for each answer that qualifies. If the answer was submitted by a group, the bonus points will be divided equally among those who submitted the answer.

7.5. Attendance

The usual practice shall be for attendance to be checked soon after homework accomplishment reports have been collected. Students who arrive in class while attendance is being checked shall be considered present, but shall not be allowed to submit homework accomplishment reports.

Attendance may be checked at any time during class, any number of times. Absence from class at any time attendance is checked shall be considered a cut. No definite grace period is required before attendance is checked.

Students who arrive after attendance has been checked shall be barred from class. Those who insist on staying shall be given demerits.

Students who have exceeded the allowed number of cuts shall be given a grade of W, and shall be barred from class for the rest of the semester.

8. ENGMA 101 Discussion Group

A discussion group for ENGMA 101 will be organized if there is sufficient interest among students. The discussion group shall serve as a forum for discussing various matters related to the course. Participation in the discussion group shall not be a requirement of the course. However, those who contribute significantly to the discussion group may be given higher grades than those determined from the class standing.

9. Homework Accomplishment Report Form

See next page.

Homework Accomplishment Report

date: _____

I, _____, hereby claim full credit for the following exercises
(printed name)

assigned as homework for today:

Furthermore, I hereby claim half credit for the following exercises assigned as homework for today:

I hereby affirm that I make all these claims in accordance with the policies set forth in the course syllabus for ENGMA 101 for this summer semester of 2004.

(signature over printed name)