Department of Mathematical Sciences
Carnegie Mellon University

MATH 21-122
Integration, Differential Equations and Approximation
Summer 2012

Instructor: Daniel Rodríguez
Office: Wean Hall 8209
Phone: 412-589-8825
E-mail: drod@cmu.edu

Lectures: Scaife Hall 214, M-F 10:30am-11:50am
Course Webpage: `http://www.math.cmu.edu/~dfrodrig/s21122.html`
Office Hours: Tuesdays and Thursdays 4pm-5pm
Text: James Stewart, *Essential Calculus, Early Transcendentals*, 6th edition.

Prerequisites: A grade C or better in a course on Differential and Integral Calculus (21-120, 21-112 or 21-121), or special permission from the department. In particular the student is assumed to know how to manipulate trigonometry, exponential and logarithmic expressions, to differentiate functions of one variable and the basic techniques of integration (substitution rule).

Course Content: This course is the second course in the Calculus series. The class will cover techniques of integration, differential equations, numerical approximations, sequences, series, Taylor polynomials and parametric curves. The course will also provide applications of these techniques to physics and engineering.
Specific Objectives:

- Learn the standard techniques of integration: Integration by parts, trigonometric substitution and partial fractions.

- Learn how to solve separable, linear and homogeneous first order differential equations, and also basic second order linear differential equations.

- Learn how to manipulate and interpret parametric curves and polar coordinates.

- Learn the concepts of sequence and series and convergence criteria.

- Learn how to approximate using Taylor Series, Euler's method and Newton's method.

- Learn how to apply all the techniques described above to problems in physics and engineering.

Homework: Homeworks are essential for the learning process, the practice makes the master. There will be one homework weekly and will be collected during the lecture hour on Tuesday. By necessity the homework will be rather long, so try to avoid doing the homework in the last minute (they are planned to be worked during the whole week). Late homeworks will not be accepted unless there is a proper justification. Even though discussing the homework with other students is permitted, the writing should be done individually. The lowest score of your homeworks will not count for the final grade :).

Quizzes: There will be in-class quizzes, some times announced, and some times they will be unannounced (surprises are good).

Exams: There will be 2 closed-book, closed-notes midterm exams, they will take place during the normal class time and in the usual room. The midterms will be on July 18th and August 3rd. Of course the use of calculators and formulae sheets is not allowed. Make-up exams will only be given if a valid excuse is provided. The Final Exam will be the 10th of August (same rules as the midterms: no books, no notes).

Grades: The final grade will be out of 100 points. It will be calculated as follows

- Homeworks 20 %

- Quizzes 15 %

- Midterm Exams 40 % (20 % each)

- Final Exam 25 %

The grade cutoff will be[1]: 90-100 is an A, 80-89 is a B, 70-79 is a C, 60-69 is a D and anything below 60 is an R.

---

[1]the cutoff may be lower but never higher than this.

The Course Schedule[2]

Day	Content	Recommended Exercises
July 2	Review: 5.5. Substitution Rule	9,10,11,15,19,24,31,41,43,46,50
July 3	6.1. Integration by Parts	3,4,8,9,10,12,13,14,16,31,33,41,43
July 4	Independence Day, No Classes	Enjoy and be happy
July 5	6.2. Trigo Substitution, and Trigo Integrals	1,3,15,19,34,49,59,61,65
July 6	6.3. Partial Fractions	1,3,5,6,11,25,27,29,41,42,46
July 9	6.5. Approx. Integration	7,9,11
July 10	6.6. Improper Integrals	1,2, 5,14,25,29,49,59,62
July 11	Problem Session Chapter 6	
July 12	Review 7.1.-7.3./ 7.4. Arc Length	7.2: 9,21, 7.3:17,25, 7.4: 3, 7,9
July 13	7.4. Arc Length/7.5 Physics	7.5: 4,5,6,8,22,37,43
July 16	7.6. First Order DiffEQ (Separable/Linear)	1,3,5,7,21
July 17	7.6. First Order DiffEQ(Linear/Homogeneous)	exercise sheet will be provided
July 18	FIRST MIDTERM EXAM (5.5.-7.4)	
July 19	8.1. Sequences	1,3,4,5,9,11,21,30,32,37,39
July 20	8.2. Series	3,4,5,7,9,14,17,27,33,39,47
July 23	8.2./8.3. Convergence Tests	8.3: 3,4,5,6, 8.4: 2,7,13,14
July 24	8.2./8.3. Convergence Tests	8.3:11,15,17, 8.4: 19,14,15,27
July 25	8.5./8.6. Power Series	8.3: 3,4,5,6,7,8,13,17,21
July 26	8.5/8.6 Power Series	8.4: 2,,3,6,7,13,21,22,23,39
July 27	8.6.Taylor Series	5,7,9,10,11,13
July 30	8.7./8.8. Taylor Series	8.7: 15,16, 8.8: 13,14,23,24,28,29
July 31	Problem Session Series/Power Series	
August 1	9.1/9.2 Parametric Curves	9.1: 4,7,9,13,15, 9.2:1,2,3,13,
August 2	9.2/9.3 Parametric Curves/Polar Coord	21,23,30,49 9.3:1,3,5,13,19,23
August 3	SECOND MIDTERM EXAM (7.6-8.8)	
August 6	Second (and higher) Order DiffEQ (homogen)	exercise sheet will be provided
August 7	Second (and higher) Order DiffEQ (undet. coef)	exercise sheet will be provided
August 8	Second (and higher) Order DiffEQ (Variat of param)	exercise sheet will be provided
August 9	Review/ Problem Session	

Note: The recommended exercises are a supplement to the homework (need not to be handed in). Of course, you should work most of the problems of the book for having strong preparation for the exams, recall that a good way of preparing for the exam is doing many exercises without looking your notes or the book. It could well happen that one or more of those recommended exercises appear in the exams/homeworks or quizzes ;).
Student with disabilities: Any student with documented disability can ask for special accommodations, if so just talk to me so that we arrange the accommodation. For more information you can go to http://www.cmu.edu/hr/eos/disability/index.html.

Last but not least, if you have any questions about the syllabus, homework, etc. you can feel free to contact me.

---
[2]The schedule is subject to change