MAA 5105/4103 Advanced Calculus (E and PS 2)

MAA 5105 & 4103 Introduction to Advanced Calculus & EPS 2 (Sections 4522 & 1C09)

Instructor: Sergei S. Pilyugin http://people.clas.ufl.edu/pilyugin/courses/maa5105_s2019/

- Announcements: There are no current announcements.
- Prerequisites: MAA 4102/5104 (Advanced Calculus 1).
- Time and Room: MW 5:10-6:25 p.m., PAA 204.
- Final Exam Time and Room: TBA.
- Critical dates: Jan. 3 (classes begin), Apr. 20 (classes end), Quizzes: TBA, Midterms: TBA.
- Midterms: Jan. 18 (MLK Day), Feb. 27 – Mar. 5 (Spring Break).
- Office Hours: MWF 10:40-11:30 a.m. (in LIT 458), or by appointment. Please, call me at 352-394-2308 or use e-mail pilyugin@ufl.edu for communication. For more details, see my schedule.

**Description and Objectives of the Course:**

This course is continuation of MAA 4102/5104 covering the topics of Riemann integral, numerical and functional series, as well as multivariate calculus.

**Weekly Schedule:**

- W1: Review of mean value theorems and Taylor's theorem.
- W2: Riemann integral, introduction.
- W3: Properties of integrable functions;
- W4: Antiderivatives, improper integrals;
- W5: Infinite series, convergence tests;
- W6: Absolute vs. conditional convergence;
- W7: Sequences and series of functions, point wise vs. uniform convergence;
- W8: Power series, Taylor series;
- W9: Vectors in \( \mathbb{R}^n \), dot and cross product;
- W10: Analytic geometry, parametric equations;
- W11: Basic topology in \( \mathbb{R}^n \), limits and continuity;
- W12: Differentiation in \( \mathbb{R}^n \), directional derivatives, chain rule;
- W13: Introduction to multiple integrals;
- W14: Applications.

**Grading System:**

Grades are determined on the basis of homework assignments, quizzes, midterms, and the final exam according to the following grading scale:

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<th>Grade</th>
<th>Letter Grade</th>
<th>Score</th>
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**Course Policies:**

- Closed book policy: No use of calculators, or books will be allowed during any in-class tests/quizzes.
- Prerequisite policy: Students will not be allowed to make up any work not submitted. However, if a student provides a legitimate excuse well in advance, the instructor reserves the right to give them a reasonable number of days to complete the assignment. Late work will not be accepted.
- Final grade determination: The resulting score determines the letter grade according to the following table:

**Homework Problems:**

For advanced calculus II Spring 2016

- Section 5.4: 2, 3, 7, 9, 10, 15, 16, 22, 25, 35, 41, 51, 52;
- Section 6.1: 3, 4, 6, 8, 10;
- Section 6.2.1: 1, 2, 5--8, 10, 11, 13, 14;
- Section 6.3: 2, 4, 8, 11, 13, 14;
- Section 6.4: 7, 10, 11, 13, 14, 18, 22;
- Section 6.5.1: 9, 10, 16, 17, 20, 24;
- Section 6.7.1: 2, 3, 6, 11, 21, 22, 28, 29, 31;
- Section 7.1: 1--9, 10, 14, 16, 18;
- Section 7.2.1: 1, 2, 5, 6, 9, 11, 13--15;
- Section 7.3.1: 2, 4, 7, 9, 13, 16, 19;
- Section 7.4: 1, 2, 4--9, 10, 11, 16, 20;
- Section 7.5: 1--7, 9--15, 19, 23--28, 34, 36--38, 41;
- Section 8.1: 2, 4, 5;
- Section 8.2: 1--5, 8;
- Section 8.3: 1, 2, 8--11;
- Section 8.4: 2, 5, 6, 8, 11, 12, 15, 18, 21;
- Section 8.5: 2, 3, 6, 10, 13;
- Section 8.6: 1, 2, 4, 6, 7, 8, 11;
- Section 8.7: 1--9, 11--15, 17--19, 22, 23, 30, 31, 35, 36, 42--44;
- Section 8.9: 2, 4, 5, 7, 8;
- Section 8.9.1: 1--5;
- Section 9.1: 2, 5, 7--9, 11, 21, 23, 24, 27;
For the final exam, you will need to review the following:

**Theorems/Lemmas (statements and proofs):**
- 5.3.1, 5.3.3, 5.4.8, 6.1, 6.2, 6.4, 6.4.5, 6.3.3, 6.3, 6.10, 6.10, 6.1, 6.4, 6.4.4, 7.2, 7.2.10, 7.3, 7.3.3, 7.4.2, 8.1, 8.3, 8.5, 8.8.

**Statements only:**
- 6.5.16, 6.5.17, 7.6.2, 7.6.10, 8.3, 8.3.7, 8.4.1, 8.4.11, 8.4.13, 8.4.14, 8.4.15.

**Definitions (with examples and counterexamples):**
- Taylor's polynomial, Riemann integrable functions, Riemann integral, improper Riemann integral, absolute and conditional convergence of integrals/series, pointwise and uniform convergence of functional sequences/series, power series, radius and interval of convergence, Taylor's series, dot product, cross product.

**Homework problems for Advanced Calculus I Fall 2015**

- Section 1.3: 2, 3, 5;
- Section 1.4: 1, 2, 4, 5;
- Section 1.7: 1, 2, 3, 5, 11, 13--16;
- Section 1.9: 13--17, 28--29, 32--34;
- Section 2.1: 2, 3, 5, 7, 10, 12, 14--17, 19--21;
- Section 2.2: 3, 5, 8, 11, 15--17, 19, 21;
- Section 2.3: 2, 3, 5, 7, 10, 11, 14, 16;
- Section 2.4: 4--7, 9, 11, 13, 16, 17;
- Section 2.5: 2, 3, 5--7, 11, 15, 17--19;
- Section 2.6: 2, 4, 5, 7, 9;
- Section 2.7: 1--4, 6--8, 12--19, 22, 27, 28, 30--32, 35, 39, 42, 43, 45, 46, 50;
- Section 3.1: 4, 5, 7, 8, 10, 11, 15;
- Section 3.2: 1, 3, 8, 9, 13, 15;
- Section 3.3: 4, 5, 8, 9, 10, 12, 13, 15;
- Section 3.4: 1--7, 15, 17, 23, 24, 26, 41--43;
- Section 4.1: 1, 2, 3, 5, 6, 9, 10;
- Section 4.3: 1, 3, 7, 13, 14, 17, 19;
- Section 4.4: 1, 2, 9, 10, 12, 13;
- Section 4.5: 1, 2, 5, 9, 10, 15--17, 20, 23, 27, 30, 32, 43, 44;
- Section 5.1: 2, 3, 6, 7, 9--12, 15;
- Section 5.2: 1, 3, 6, 7, 12, 13;
- Section 5.3: 1, 2, 3, 5, 7, 9--11, 15, 17, 19, 21, 27, 29;
- Section 5.4: 2, 3, 5, 8--10, 21--23, 27, 29, 32;
- Section 5.6: 2, 4, 7, 9, 10, 15, 19, 22, 25, 35, 41, 51, 52;

For the final exam (Chapters 1-5):

**Theorems to know (with proof):**
- Binomial theorem 1.3.7
- Theorem 1.7.10 (sets Q and I are dense in R)
- Theorem 2.1.11 (convergent sequences are bounded)
- Theorem 2.2.6 (squeeze for sequences)
- Theorem 2.3.7 (ratio test)
- Theorem 2.4.4 (monotone sequences)
- Theorem 2.5.4 (Weierstrass-Monotone for sets)
- Theorem 2.5.9 (Cauchy-convergent)
- Theorem 2.6.4 (Weierstrass-Monotone for sequences)
- Theorem 4.2.5 (intermediate value)
- Theorem 4.3.16 (Intermediate value)
- Theorem 4.4.6 (continuous on closed bdd set=> unif. continuous)
- Theorem 5.3.1 (Rolle's theorem)
- Theorem 5.3.3 (Lagrange's Mean Value theorem)

**Definitions:**
- Limit of a sequence
- Inf/Sup/Min/Max of a set
- Accumulation point
- Limit of a function
- Sided limits
- Limits at infinity
- Infinite limits
- Continuity
- Uniform continuity
- Derivative of a function