NORTH CAROLINA STATE UNIVERSITY, DEPARTMENT OF MATHEMATICS

MA 131 – Calculus for Life and Management Sciences A, Fall 2019

NOTE: This is the master syllabus, outlining MA 131 topics for all sections, and intended for the use of course instructors, rather than MA 131 students. This is NOT a University-compliant syllabus, which requires many more details (see https://policies.ncsu.edu/regulation/reg-02-20-07/ for required elements and http://delta.ncsu.edu/apps/syllabus_tool/ for an online syllabus generation tool.)

TEXTS: 1. **Required:** Goldstein, Lay, Schneider and Asmar, Calculus and its Applications (11th, 12th, 13th or 14th ed.)

2. (**Online free download** through WebAssign): MA 131 Supplement

The 14th edition of Goldstein, Lay, Schneider and Asmar is the most recent. Any recent edition should be useable, although Instructors are warned that homework exercises do vary between editions, as does some organization of the material. (Earlier editions only had the first three authors.)

WEBASSIGN: WebAssign homework exercises are now available for MA 131. (Jennifer George should send out an announcement for Instructors who wish to make use of them.) These questions were developed by Alun Lloyd and are not drawn from the textbook but are similar in spirit. Some areas of the syllabus are given less emphasis in the question set.

The availability of WebAssign exercises means that access to homework questions is independent of having the textbook.

COURSE OUTLINE and SCHEDULE:

This is the first semester of a two-semester sequence in calculus for students in the life and management sciences. **Emphasis should be placed on ideas and concepts, including the contexts within which this material is used, while less importance should be placed on computations and algebraic manipulations**. (Proofs need not be discussed.) The text attempts to have the sort of balance that we intend. Real-world examples should feature in your presentation of the material. Applications of calculus should be emphasized, particularly optimization and growth and decay problems.

Tests should reflect the intent of this course (e.g. include "word problems" and require students to understand what they are doing and why, rather than being exclusively focused on purely mechanical problems).

Four tests are scheduled and the lowest of these grades should be dropped if the total number of absences (excused or unexcused) does not exceed by more than one the number of times the class meets each week. Test dates have been chosen to avoid conflicts with the core chemistry and physics classes typically taken by MA 131 students; test dates should not, therefore, be changed.

The main topics of MA 131 are first order linear difference equations, with a focus on financial models, differential calculus and its applications, and integral calculus.

For Instructors who are new to MA 131:

Remember that the students taking MA 131 are not math, engineering or physical sciences students!

There is a fair bit of material to be covered during the semester and you might struggle to cover everything in the syllabus. Since MA 231 relies on material from MA 131, omitting material from the end of the syllabus (integrals) is not advised. There are some earlier applications sections that can, possibly, be omitted. (Sections 2.7 and 5.2 from the textbook come to mind.) Since my interests are in the biological sciences, I tend to emphasize those applications over the financial ones [but I make this clear early on during the semester]. This helps me to save some time.

You will also find that the students have a wide range of abilities entering MA 131. Many need to spend time reviewing precalc (chapter 0 of the main textbook), although, unfortunately, I don't find that there is enough time to go through that chapter. On the other hand, many students have taken AP Calculus at high school and are taking MA 131 to get a good grade during their first semester; these students usually sail through the differentiation material and only start to have any sort of difficulty with the last sections on integrals.

If I can be of any help, please feel free to get in touch with me.

Alun Lloyd,
Course Coordinator

Sections	Topics
10.1-10.4 (supplementary text)	Difference equations and applications
1.1-1.4 (main text)	Limits and Derivatives

TEST #1 on Friday, September 13th

1.5-1.8	Differentiability, continuity and rates of change
2.1-2.7	Applications of the derivative

TEST #2 on Monday, October 7th

3.1-3.2	Rules of differentiation
4.1-4.6	Exponential and logarithmic functions
5.1-5.2	Applications to population growth and compound interest

TEST #3 on Friday, November 1st

6.1-6.5	The definite integral
9.1, 9.3-9.4	Integration by substitution, evaluation of integrals

TEST #4 on Monday, November 25th (***note this is the Monday of Thanksgiving week)

9.5-9.6	Applications of integration, improper integrals

Sections that do not meet on these days should hold their test on the closest class meeting.

MA 131 Suggested Lecture-by-Lecture Timeline

1. Course intro, Introduction to difference equations (sec. 10.1, supp. Text)
2. "General Difference Equation", three approaches to understanding, general solution (10.1-10.2)
3. More examples, monthly compounded interest (10.2)
4. Graphing difference equations, long-term behavior (10.3)
5. General behavior of difference equation
6. Mathematics of personal finance revisited (10.4)
7. Calculus intro, motivation, straight lines (selected parts of chapter 0, Goldstein et al., intro chapter 1, and section 1.1)
8. Slopes of curves, tangent line, tangent line approximation (1.2)
9. The derivative, derivatives of simple functions, notations (1.3)
10. Limits (1.4)
11. Limit theorems, limits at infinity (1.4)
12. Differentiability, continuity, (start) rules for differentiation (1.5,1.6)
13. Rules for differentiation. More about derivatives, second derivative, derivative as a rate of change, average rates of change (1.6-1.8)
14. More examples (including position, velocity, acceleration), tangent line approximations again (1.8)
15. Applications of the derivative, descriptions of graphs (extreme points, concavity, asymptotes, etc), first derivative rule (2.1, 2.2)
16. Concavity and second derivative, second derivative rule (2.2)
17. Relationship between graph of function, derivative, second derivative. Curve sketching (2.2, 2.3)
18. More curve sketching (2.4)
19. Optimization (2.5)
20. Optimization continued (I skip 2.6). More rules of differentiation (3.1)
21. Quotient rule, chain rule (3.1, 3.2)
22. Chain rule continued (3.2). Exponential functions (4.1)
23. Rules of exponentials, logarithms (4.6 … I don't follow the textbook's presentation for this…)
24. The exponential function, differentiating (4.3)
25. The natural logarithm, differentiating (4.4, 4.5)
26. Applications of log and exp functions (5.1)
27. …continued, differential equations (5.1), Integration (6.1)
28. Antidifferentiation, Riemann Sums (6.1, 6.2)
29. Fundamental theorem of calculus (6.3)
30. Areas under curves, rules of integration. Areas in x-y plane (6.3, 6.4)
31. Areas between curves, applications of the definite integral (6.4, 6.5)
32. Solids of revolution (6.5), Techniques of integration (substitution) (9.1)
33. Substitution continued, substitution and definite integrals (9.3) [SKIP integration by parts]
34. Approximating areas under curves (9.4)
35. Improper integrals (9.6)

I make it that there are 43 scheduled (50 minute) class meetings in the Fall semester. Four are taken up with tests, so the above schedule leaves 4 free classes for review, either before tests or before the final exam.

WebAssign Homeworks (12 main homeworks, 6 mini-homeworks)
(List as of Fall 06. Assignments might be updated periodically.)

Mini-homeworks are shorter exercises. I try to use them between one class and the next to ensure that the main points of a lecture were understood.

Difference Equations (I) (after lecture 2)
Mini-homework: Difference Equations (after lecture 4)
Difference Equations (II) (after lecture 6)
Derivatives and tangent lines (after lecture 9)
Limits, Continuity and Differentiability (after lecture 12)
Derivatives (II) (after lecture 14)
Applications of Derivatives (after lecture 18)
Optimization (after lecture 20)
Mini-homework: Product, Quotient and Chain Rules (after lecture 21)
More Rules of Differentiation (after lecture 22)
Mini-homework: Exponential Functions (after lecture 24)
Mini-homework: Rules of Logarithms (after lecture 25)
Exponential and Logarithmic Functions (after lecture 25)
Applications: Exponential and Logarithmic Functions (after lecture 27)
Mini-homework: Antiderivatives (after lecture 28)
Mini-homework: Area under Curves, Riemann Sums (after lecture 28)
Integrals and Areas Under Curves (after lecture 31)
Mini-Homework: Solids of Revolution (after lecture 32)
Further Integration (after lecture 35)

The “review assignment” is a collection of questions from the above homeworks and mini-homeworks to allow for some additional practice. *I do not set this assignment for credit.* The students should see different randomized numbers in their questions. By default, a large number of submission attempts are given per question.

Note: these WebAssign exercises were put together by a non-specialist and so may not be quite as robust as question sets written by textbook publishers. In particular, there is some issue with tolerances on some questions, and I know there is one integration question where an alternative way of doing the substitution can lead to a correct answer that is not accepted by WebAssign [unfortunately, I cannot immediately remember which question this is… although I have only ever had a couple of reports of issues]. **Please pass feedback on the WebAssign along to Alun Lloyd.**