Syllabus B for MAC 2312;
Draft, December 1, 2020

Textbook: *Calculus, Early Transcendentals* - 3rd Edition, by Briggs, Cochran, Gillett, Schultz Publisher: Pearson. ISBN 13: 978-0-13-476364-4 , ISBN 10: 0-13-476364-5. Students may also purchase just access to MyLabMath online system and get electronic access to the textbook this way.

Pace and Schedule: The schedule below is based on a course that meets 100 minutes twice a week for 14 weeks. It assumes about 24 class periods for lectures, with the others used for review and exams. The course includes about 32-34 sections of the textbook, so the pace should be of about 3 sections per week. Establish a good pace early, so that you are not pressed for time at the end. Avoid excessive in-class review for exams.

This course is a pre-requisite for many others, not just MAC 2313. Students will need good calculation skills in differential equations and mathematical statistics, decent proof-writing skills in linear algebra and MAA 3200, and familiarity with approximation methods and applications in various courses. Cover all mandatory topics well (see below for what is mandatory), including some proofs (see also below for a suggested list). Here, to *cover* a topic generally includes testing the student on it. It is recommended that you have a proof or a more theoretical exercise on each exam (from a short list that you could announce to students in advance). The instructor can decide if and when to allow calculators on exams, non-graphing only, but the students must know the standard formulas, such as basic trig values, and this should be tested. Students entering MAC 2312 are required to have a C in MAC 2311.

Communication with students: It is strongly recommended to use at least one of the following ways to communicate with your students outside class: Canvas, class webpage, weekly email messages (could be sent via Panthersoft).

Exams and grade structure: In regular semesters, it is recommended to have a minimum of 3 class exams (100 minutes) and a (mandatory, comprehensive) final exam (120 minutes). It is strongly recommended to have a graded homework component (online or paper-pencil) for about 10% of the grade and quizzes/worksheets also for about 10% of the grade. An online homework assignment (in MyLabsPlus) is available from the coordinator and you could use it as is or customize it. In short semesters, such as Summer A or B terms, the instructor could reduce to 2 the number of class exams, and could skip most of the optional sections/topics below.

Weights in the overall grade:
– Online assignments or other graded homework: 8% to 12% of the overall grade;
(It is mandatory to have a homework component as above - voted in Fall 2019) ;
– Quizzes/worksheets/participation: 8% to 12% ;
– Class exams: 54% to 60%;
– Final exam: 20% to 26%.
It is strongly recommended to use a (partial) replacement policy for the lowest exam by the final, if beneficial to the student. (I usually replace the lowest midterm by the average of that midterm and the final, and I announce this policy in the syllabus.) Final exam could weigh more if beneficial to student (e.g. by replacing or improving a lower score on a class exam), but the instructor should announce such policy.

80% rule: It is strongly recommended that all instructors adhere to the following rule: at least 80% of the questions on all exams be very close to problems in the homework (online or suggested) or the in-class materials (worksheets/class-notes).

Grade scale: It is mandatory (by a vote in Fall 2019) to have 65% as passing line for C for all sections. You can lower this line at the end of the semester but not increase it.
Below is my typical grade scale, small variations on this are OK.

A above 90; A- 88-89; B+ 85-87; B 80-84; B- 78-79; C+ 73-77; C 65-72; D 55-64; F 0-54.

Your syllabus in the zoom teaching era should contain the following:

– clear rules about participation to in-class zoom meetings (camera on, etc.) and communication with students outside class (zoom meeting links for office hours, for LA hours, etc.);
– clear rules about exam requirements, including specific provisions about additional oral examinations if you plan to use them (in my opinion, they are necessary);
– clear and strong statement about academic integrity;
– see this document shared by Laura for other syllabus advice and language
https://www.dropbox.com/s/l7xxxieqo2yclkd/FIU-Syllabus-Language-for-Fall-Courses.docx?dl=0

Notes on the order of teaching the material:

– Starting the course with Chapter 5 is the most obvious choice. With Anton's textbook, following John Zweibel, I experimented with fairly good success starting the course with sequences and a bit of series (the equivalent of sections 10.1, 10.2 from Thomas) and then starting Chapter 5 and so on. You could try this, but be aware that some review of Section 10.2 might be necessary later on when the coverage of most of Chapter 10 will be done.

– Covering section 7.1 (logarithm as a definite integral) right after section 5.6 (definite integrals) is strongly recommended, as most of the exercises in section 7.1 are substitution exercises involving ln-function.

– I've also experimented covering Chapter 11 right after Chapter 8 and before series. I discourage this, as it runs the risk of not leaving enough time at the end of the semester for the last sections on series.

My personal note on Thomas textbook: Overall, for Calculus 1 and 2 material, I like much more the coverage from our old textbook, Anton. Often, I find that Thomas does not choose the natural order of presenting the material. The selection of exercises for many sections is also rather poor in Thomas. Probably Pearson's online system MyLabsPlus is superior to WileyPlus, but Briggs would have offered this online system AND a presentation of material very much like Anton (maybe even friendlier to students than Anton).

Notes on coverage for each chapter

Chapter 5 Integration
Sections 5.1-5.6: about 4 lectures of 100-minutes [approx 7 shorter lectures].

Section 5.5 (substitution method for indefinite integrals) should have been covered in Calculus 1, but, because of its importance, you could review it with 5.6. Try to establish a good pace. Include plenty of practice with the Fundamental Theorem of Calculus, usually including the proof.

Differences vs. Anton: no special section on rectilinear motion with integration; no special section on the average value of a function (concept which appears as early as section 5.1); note the general definition of integral and the different notations (e.g. c_k instead of x_k^* for the chosen points in a partition, etc.); the logarithm as an integral is the first section of Chapter 7. Probably the best place to cover section 7.1 is after section 5.6, as most of its exercises are substitutions involving logarithm. A light coverage of section 7.1 is fine, but this is still a mandatory section.

Proofs: This is a suggested selection of proofs, or more theoretical exercises you could ask students to know from this chapter and possibly test on exams:

– Example 4 in section 5.2 ("baby" Gauss summation formula);
– Theorem 4 -part 1, Theorem 4 -part2 in section 5.4 (both parts of FTC – assuming without proof MVT for integrals);
– Proof of "Leibniz's Rule" (top of second column on page 366);
– Computing limits via Riemann sums and integrals (e.g. exercises 22-26 on pages 365, 366 textbook).

Chapter 6: Applications of Integration
Sections 6.1-6.4 and 6.5(work only), about 4 lectures.

The student should learn to convert new word problems into integrals via Riemann sums. Justify the slicing and shell methods to firm up the idea of integration. Cover only the work part of section 6.5 as a non-geometric application of integral (in view of time, do not cover fluid forces). For one more quick non-geometric application, you could cover just the mass of a thin wire of variable density from 6.6 (but this is optional). Try not to spend too much time in this chapter, if you are not sure about the coverage of the remaining material. You may omit a topic or two from sections 6.4, 6.5 in a short summer semester; also, the trickier antiderivatives that arise with arc length and surface area are optional. At a minimum, cover 6.1-6.3 and do a couple of non-geometric applications (e.g. Work).

Suggested proofs or more theoretical exercises:

– Finding the formula for the volume of a sphere;
– Finding the formula for the volume of a cone or a pyramid;
– Finding the formula for the volume of a torus (e.g ex. 57, page 378);
– Work = Change in kinetic energy (ex. 25, page 406).

Chapter 7: Integrals and Transcendental Functions
Only section 7.1 is mandatory (light coverage after 5.6 is suggested), but section 7.2 Exponential Change and Separable DEs is a good optional section (if time allows). (1 lecture)

Chapter 8: Techniques of Integration.
Mandatory are sections 8.2, 8.3, 8.4, 8.5, 8.7, 8.8: 5 lectures

You may just do one or two examples from 8.1 and (possibly) assign some exercises, but don't spend more than 10-15 minutes of class-time on it. You may also go very briefly over integral tables (section 8.6). Department policy normally forbids formula sheets on exams, but you can make exceptions if you want to test the use of tables; also for reduction formulas and error estimates.

Require lots of student practice in this chapter, but don't get bogged down in class. In a short semester, you may omit/reduce time on reduction formulas, applications, and the longer problems from sections 8.2-8.5. Do cover section 8.7 numerical integration and some word problems involving data from tables, but consider as optional the error estimates (there is no reasonable way to justify those formulas without Taylor's theorem). Note that this textbook does NOT mention midpoint approximation. I do like to cover here that $T_n = (L_n + R_n)/2$, $S_{2n} = (2M_n + T_n)/3$, as these give non-memorizing way of finding formulas for the trapezoid and Simpson's approximations.

Suggested proofs or more theoretical exercises:

– Integration by parts formula;
– Obtaining a reduction formula (some in exercises of section 8.2; a few others just stated in the optional section 8.6 – see bottom of page 494);
– Finding the area inside of an ellipse (Ex. 58 page 484, section 8.4).
– Showing that the weighted average $(2M_1 + T_1)/3$ gives the exact value for the $\int_a^b x^2\,dx$ (this essentially justifies the formula above for the Simpson approximation).

Chapter 10: Infinite Series.
Sections 10.1-10.10, 7-8 lectures.

Cover all sections carefully with emphasis on the idea of convergence and the use of Taylor series.
Show how to use convergence tests and error estimates for Taylor series. and (if time permits) cover most of the proofs. Students must memorize the McLaurin series of the basic functions such as $1/(1-x)$, e^x, $\sin(x)$ and to be able to find others by substitution, multiplication, differentiation and so on. Include plenty of practice with intervals of convergence. Use power series to approximate functions and integrals, to compute limits, and perhaps to solve an ODE.

Suggested proofs or more theoretical exercises:

– Proof of the nth-term test for divergence;
– Proof of the geometric series theorem (stated on the bottom of page 592 and proved in the lines above);
– Proof of the p-series test from the integral test (done in Example 3, page 602);
– Proof of the direct (simple) comparison test (Theorem 10 on top of page 607).

Chapter 11: Polar Coordinates, Parametric Curves, Area
Sections 1-5: 2-3 lectures.

The emphasis here should be on polar coordinates, sections 11.3, 11.4, 11.5. In principle, section 11.1 and, partially, 11.2 on parametric curves, should have been covered in Calculus 1, but review these, if time permits. Do cover arc-length in 11.2, for a good link with Calculus 3. Cover graphing and well-known families of polar curves in 11.4. Definitely cover the area formula and its proof in 11.5, with non-trivial examples; this is needed for MAC 2313.

Suggested proofs or more theoretical exercises:

– Proof of the area formula in polar coordinates (bottom of page 689 and top of page 690);

Suggested exercises from Briggs 3rd edition: (those starred denote more challenging or theoretical exercises)

Section 5.1: 5, 10, 26, 29, 48, 50(i), 61, 71 (review)
Section 5.2: 5, 11, 15, 35, 43, 53, 59-65odd, 79, 83, 86 (review)
Section 5.3: 1, 2, 5, 8, 9, 10, 14, 24, 27, 33, 38, 45, 47, 53, 57, 64, 69, 74, 75, 80 (review)
Section 5.4: 1, 2, 4, 9, 11, 15, 19, 20, 25, 27, 33
Section 5.5: 1-3, 7, 9, 13, 17, 20, 29, 31, 37, 51, 52, 55, 61, 63, 69, 79, 95
Section 7.1: 31-39 odd, 51, 57;

Section 6.1: 8, 10, 14, 19, 25, 35, 38, 40, 44
Section 6.2: 5, 6, 10, 19, 34, 38, 54
Section 6.3: 5, 11, 18, 21, 28, 30, 38, 41, 53
Section 6.4: 5-8all, 9, 14, 45, 46, 49, 55, 63, 66*, 70*
Section 6.5: 4, 10, 11, 19
Section 6.6: 9, 17, 26a
Section 6.7: 11, 12, 13, 23, 33, 39, 41

Section 8.1: 1, 3, 6, 7-21odd, 31
Section 8.2: 1, 6, 9, 11, 29, 37, 41, 42, 49, 50, 53, 73*, 74*
Section 8.3: 6, 7, 9, 11, 15, 21, 23, 27, 33, 35, 41, 53, 63, 71*, 72*, 73*
Section 8.4: 1-5all, 7, 8, 11, 15, 19, 25, 33, 57, 60, 61, 83*
Section 8.5: 4, 5-13odd, 23, 29, 43, 51, 65, 73
Section 8.6: 1-7odd, 17, 25, 27, 85
Section 8.8: 2, 3, 5, 6, 7, 15, 21, 35, 41
Section 8.9: 2, 3, 4, 9-15odd, 23, 30, 31, 62, 87a,b, 88, 111*

Section 10.1: 3, 8, 19, 27, 28, 61, 67, 68
Section 10.2: 1-7all, 13, 15, 25, 39, 51, 56, 83, 88*, 90
Section 10.3: 5, 6, 25, 27, 30, 32, 43, 47, 49, 55, 62, 77, 87, 101*
Section 10.4: 1-7all, 9, 23-29odd, 47-57odd, 70*
Section 10.5: 3-15 odd, 43-47 odd, 61, 63*
Section 10.6: 6-8all, 11-13all, 27, 45, 47, 51, 55, 57, 65
Section 10.7: 3, 6, 9, 13, 34-37all
Section 10.8: 11-15odd, 19-23odd, 30, 31, 39, 44, 48, 51, 52, 81

Section 11.1: 3, 5, 6, 11, 14, 19, 53, 55, 59, 61
Section 11.2: 1, 2, 7, 9, 20, 23, 28, 41, 43, 63
Section 11.3: 4, 7, 9, 17, 27, 36, 37
Section 11.4: 55, 60, 80*, 81*

Section 12.1: 2, 5, 7, 10-12all, 19, 21, 24, 40, 48, 54, 69, 73, 83, 89
Section 12.2: 1-3, 11, 14, 16, 17, 20, 23, 27, 33, 40, 47, 53, 54, 65, 91, 97
Section 12.3: 36, 39, 42, 51, 61