MATH 2326 - Calculus III

SEMESTER: YEAR: TIME AND ROOM:

INSTRUCTOR:

OFFICE: OFFICE HOURS:

E-MAIL: PHONE:

TEXTBOOK: Calculus: Early Transcendentals, Custom Edition for the University of Texas at Arlington, by Soo T. Tan

Faculty Profile: [Insert your Profile URL, e.g. https://www.uta.edu/mentis/public/#profile/profile/view/id/1554/.] [If you elect to include this URL, be sure that the last four digits of the address are associated with your profile, and not somebody else's.]

PREREQUISITES: C or better in MATH 2425 or HONR-SC 2425

Course Content: From the UTA Catalog: Partial differentiation, multiple integrals (with applications), line integrals, Green's Theorem, surface integrals, Stokes' Theorem, divergence theorem. Prerequisite: C or better in MATH 2425 or HONR-SC 2425

Information concerning major assignments/examinations and makeup policy: [Add to any information given: This is a course which satisfies the mathematics core requirement for the State of Texas and as such you will be ask to submit a "signature" assignment which addresses the core objectives of the course.]

Attendance Policy:

Calculation of Grade:

COURSE PURPOSE, LEARNING OUTCOMES AND OBJECTIVES (SEE ATTACHED ASSIGNMENT SHEET):

PURPOSE

This is a traditional multivariate third calculus course. It may be used to satisfy the State of Texas core requirement in mathematics and is a required course on all engineering, physics, mathematics degree plans, as well as on BS degrees in chemistry and biochemistry which lead to certification by the ACS. It also appears on various combined BS-MS degrees in science.

OBJECTIVES

The main objectives in a mathematics core curriculum course such as this one are to enhance the student’s

(1) ability to communicate effectively,

(2) ability to apply critical thinking skills, particularly to the types of real world problems encountered in the course, and

(3) skills in handling problems that are highly quantitative in nature or that require an empirical mode of thought to be successful.
LEARNING OUTCOMES

Upon completion of MATH 2326:

1. Students will be able to use the concepts of continuity, differentiation, and integration of vector-valued functions to determine unit tangent and unit normal vectors in the process of modeling objects in three dimensions. Students will be able to parametrize piecewise-smooth curves using arc length. They will be able to compute the curvature of a space curve.

2. Students will be able to compute and sketch level curves and level surfaces for functions of several variables and sketch the graphs of functions of two variables. Analyzing limits, determining continuity, and computing partial derivatives of multivariate functions is also expected. Students will be able to use tangent planes, directional derivatives, gradients, the second partials test, and Lagrange multipliers to approximate and solve optimization problems.

3. Students will be able to demonstrate techniques of multiple integration and compute iterated integrals over rectangular regions, non-rectangular regions and in other coordinate systems. They will be able to apply multiple integrals in problem situations involving area, volume, surface area, center of mass, moments of inertia, etc.

4. Students will be able to compute line integrals and surface integrals by applying the Fundamental Theorem for Line Integrals, Green’s Theorem, Stoke’s Theorem, and the Divergence Theorem. Applying these integrals to solve applications such as mass and work problems is also expected.

That these outcomes meet the aforementioned objectives of a mathematics core-curriculum course is clear from the following.

Communication Skills

The students will be offering solutions to rather involved mathematical, geometrical and real life problems throughout the course. Strongly developed communication skills are required simply to describe what one has done quite often, even in the most mathematically pure problems. These skills are particularly called upon in problems like: (a) 9,10,11 in Chapter 11.1, assignment 1 where the student is ask to match curves with their equations; (b) 49 and 50 in assignment 3, Chapter 11.2, where the student is ask to give proofs of elementary rules involving limits; (c) 44 in assignment 3, Chapter 11.3, where the student is ask to "explain what happens" as t approaches 0; 76 in assignment 7, Chapter 12.3 where the student is asked to explain their results in a problem involving a formula approximating the surface area of the human body.

Critical Thinking Skills

Being a typical multivariate calculus course high levels of critical thinking are called for throughout. For example -- using differentials to estimate the percentage error in blood flow, body surface area and resistance of parallel circuits, based upon given percentage errors in measurements of the various input variables for these quantities, requires a high degree such skills. These problems occur in assignment 8, problems 31, 33, 37. Other problems which stress critical thinking skills in notable fashion are 23 and 26 in assignment 22, Chapter 13.8, where the student is asked to evaluate a double integral over a given region by inventing his or her own transformation, then applying the
"change of variables" formula involving the Jacobian of that transformation to solve the problem.

Empirical and Quantitative Skills

Problems 1, 3, 7 on assignment 14, Chapter 13.1, probably test quantitative skills as well as any problems in elementary mathematics. There the student is asked to estimate a double integral over a given region by using Riemann sums. Problems such as 29 and 30 in assignment 25, Chapter 14.3 also stand out. There the student is given a force field, a picture of the field, and asked to determine by inspection whether the total work done on a particle moving along a given curve is positive, negative or zero. The student is then asked to work the problem using formulas to verify the answer.

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. Students will not be automatically dropped for non-attendance. Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/aoa/fao/).

Americans with Disabilities Act: The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the Americans with Disabilities Act (ADA). All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

Academic Integrity: Students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System Regents' Rule 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student’s suspension or expulsion from the University.

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at www.uta.edu/resources.
Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at http://www.uta.edu/oit/cs/email/mavmail.php.

Student Feedback Survey: At the end of each term, students enrolled in classes categorized as “lecture,” “seminar,” or “laboratory” shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student’s feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington’s effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit http://www.uta.edu/sfs.

Final Review Week: A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week unless specified in the class syllabus. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures: [NEW and REQUIRED] Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is located [insert a description of the nearest exit/emergency exit]. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.

[As you see, this new section requires faculty members to be fully aware of the exits nearest their classrooms, even before the semester begins. In the case that you are unable to ascertain this information in time for your syllabus, you must be sure to explain to your students on day one how best to exit the building. Inclusion of this verbiage as well as a brief discussion on the matter with your students at the beginning of the term is mandated by UT Arlington Procedure 7-6: Emergency/Fire Evacuation Procedures (https://www.uta.edu/policy/procedure/7-6).]

Course Schedule. [Required]
You must provide students with a schedule / timetable for the course. Furthermore, per House Bill 2504, your course schedule must “[provide] a general description of the subject matter of each lecture or discussion.”

In your course schedule, you should strive to indicate (to the extent possible) dates for all major work to be completed. (The definition of “major” is left to the discretion of each instructor.)

Immediately before or after the course schedule, you are encouraged to include the following verbiage (or something similar): “As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course. –First M. Last.” Should you find such adjustments to be necessary, please do your best to advise students in a timely manner. (The definition of “timely” is left to the discretion of each instructor.)

If you plan to include important administrative dates (e.g., the officially-scheduled time slot for your course’s final examination, the last day to drop), please be sure to double-check the relevant information published by the Office of Records and Registration. Particularly useful are the pages for Faculty and Staff Services and for the Academic Calendar.
SIGNATURE ASSIGNMENT FOR MATH 2326

1. #44, p.1005, 11.3 (assignment 3)
2. #4, p.1065, 12.3 (assignment 7)
3. #76, p. 1067, 12.3 (assignment 7)

These three problems thoroughly test Communication Skills (and as always, Critical Thinking skills). Problem 1 calls for the student to explain what happens to the curvature \( \kappa(t) \) of a curve as \( t \) approaches 0. Problem 2 asks the student to match three 3-dimensional graphs with a function of two variables and its two partial derivatives, and to explain the reason behind their answer. This problem calls for both a very high level of Critical Thinking Skills and Communication Skills. Problem 3 involves an empirically obtained formula for the surface area of the human body as a function of weight \( W \) and height \( H \). The student is asked to find the partial derivatives of the function with respect to \( W \) and \( H \) and to interpret the results when \( W=70 \) and \( H=180 \) (with appropriate units). This meaning of what is called for not only requires careful Critical Thinking but also a very well crafted explanation, i.e. Communication Skills.

4. #31, p. 1079, 12.4 (assignment 8)
5. #23, p.1213, 13.8 (assignment 22)

These problems stress Critical Thinking Skills more than many in the course. Problem 4 involves again a formula for the surface area \( S \) of a human body in terms of weight \( W \) and height \( H \). This time the student is asked to estimate using differentials the maximum percentage error in \( S \), given the maximum errors in the measurements of \( W \) and \( H \). No explanation is called for, and the computational skills called for are minimal for math at this level. However, the very act of translating the words on paper in this problem into an appropriate mathematical formulation requires a high level of critical thinking.

6. #7, p. 1151, 13.1 (assignment 14)
7. #10, p. 1213, 13.8 (assignment 22)

Quantitative Skills of both the number crunching and symbolic manipulation types are evaluated here. Problem 6 calls for a Riemann sum approximation of a double integral (involving 16 rectangles and their midpoints). Problem 7 calls for the evaluation of the Jacobian of a given transformation, and as such not only involves numerous partial derivatives but the evaluation of the resulting determinant.