MA 242 Course Syllabus

MA 242 – Calculus III

Section 651

10-week Summer Session 2020

4 Credit Hours

Course Description

Third of three semesters in a calculus sequence for science and engineering majors. Vectors, vector algebra, and vector functions. Functions of several variables, partial derivatives, gradients, directional derivatives, maxima and minima. Multiple integration. Line and surface integrals, Green's Theorem, Divergence Theorems, Stokes' Theorem, and applications. Use of computational tools.

Learning Outcomes

After successfully completing this course, students will be able to:

1. Use the techniques of partial differentiation and multivariable integration to explore the properties of functions of two or more variables
2. Set up and solve optimization problems in various contexts
3. Compute line, surface and volume integrals in various coordinate systems
4. Identify conservative vector fields and integrate them to find their potential functions
5. Apply the theorems of Green, Stokes and Gauss to various problems in geometry and the sciences

Course Structure

This course is an online course. There are 56 video lectures covering the relevant sections of the textbook. Students devise a weekly schedule based on the supplied week-by-week schedule of topics. There will be four regular tests during the semester plus a comprehensive final exam. See the "Course Schedule" below for test dates. In addition, there will be online WebAssign homework for each section of the textbook that we cover.

Instructors

Larry Norris (lkn) - *Instructor*
Email: lkn@ncsu.edu
Web Page: http://lkn.math.ncsu.edu
Phone: 919-515-7932

Office Location: SAS 4216
Office Hours: M,W,F. noon-1pm

Course Meetings

Lecture

Days: daily
Time: scheduled by the student

Course Materials

Textbooks

Calculus for Engineers and Scientists, Vol. III - Franke, Griggs, and Norris
Edition: 1st
WebAssign Homework

Web Link: https://www.webassign.net/ncsu/login.html
Cost: Approximately $77.95
This textbook and homework are required.

Materials

The textbook, which you will access via WebAssign, is in streaming video format.

Requisites and Restrictions

Prerequisites

MA 241 *with grade of C- or better or AP Calculus credit, or Higher Level IB credit.*

Co-requisites

None.

Restrictions

None

General Education Program (GEP) Information

GEP Category

Mathematical Sciences

Transportation

This course is entirely on-line and will not require attendance at the NCSU campus.

Safety & Risk Assumptions

None.

Grading

Grade Components

Component	Weight	Details
WebAssign Homework	**20%**	There will be a WebAssign homework set for each section of the textbook
Midterm Tests	**50%**	There will be four 60 minute midterm tests. One page of notes allowed for each test.
Final Exam	**30%**	The comprehensive final exam will be 180 minutes. One page of notes allowed.

Letter Grades

This Course uses Standard NCSU Letter Grading:

$97 \leq$ **A+** ≤ 100
$93 \leq$ **A** < 97
$90 \leq$ **A-** < 93
$87 \leq$ **B+** < 90
$83 \leq$ **B** < 87
$80 \leq$ **B-** < 83
$77 \leq$ **C+** < 80
$73 \leq$ **C** < 77
$70 \leq$ **C-** < 73
$67 \leq$ **D+** < 70
$63 \leq$ **D** < 67
$60 \leq$ **D-** < 63
$0 \leq$ **F** < 60

Requirements for Credit-Only (S/U) Grading

In order to receive a grade of S, students are required to take all exams and quizzes, complete all assignments, and earn a grade of C- or better. Conversion from letter grading to credit only (S/U) grading is subject to university deadlines. Refer to the Registration and Records calendar for deadlines related to grading. For more details refer to http://policies.ncsu.edu/regulation/reg-02-20-15.

Requirements for Auditors (AU)

Information about and requirements for auditing a course can be found at http://policies.ncsu.edu/regulation/reg-02-20-04.

Policies on Incomplete Grades

If an extended deadline is not authorized by the instructor or department, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at http://policies.ncsu.edu/regulation/reg-02-50-3.

Late Assignments

- If a student has a University approved excused reason for turning in an assignment late, they will not be penalized if the assignment is turned in within one week of receiving the assignment (or another negotiated time). Students wishing to take advantage of this must contact their instructor.
- If the late assignment is unexcused, automatic extensions can be requested in WebAssign for a 24 hour period up to 5 days after an assignment is due with a 40% reduction in points earned during the extension period.

Attendance Policy

For complete attendance and excused absence policies, please see http://policies.ncsu.edu/regulation/reg-02-20-03

Attendance Policy

Students are expected to keep a regular schedule for viewing video lectures and doing WebAssign homework.

Absences Policy

Students with a University approved excused absence will not be penalized.

Makeup Work Policy

Test Make-Up Policy: All anticipated absences must be excused in advance of the test date. These include university duties or trips (certified by an appropriate faculty or staff member), required court attendance (certified by the Clerk of Court), or religious observances (certified by the Department of Parent and Family Services 515-2441). Emergency absences must be reported as soon as possible once returning to class and must be appropriately documented (illness by an attending physician or family emergencies by Parent and Family Services). If you are sick on a test day and decide not to take the test, go to the health center or

other medical facility. Students who miss a test and have a university approved excuse must submit appropriate documentation.

Additional Excuses Policy

None.

Academic Integrity

Academic Integrity

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at http://policies.ncsu.edu/policy/pol-11-35-01

Both faculty and students at North Carolina State University have a responsibility to maintain academic integrity. An informational brochure about academic integrity is available from the university and students are encouraged to obtain a copy.

Academic Honesty

See http://policies.ncsu.edu/policy/pol-11-35-01 for a detailed explanation of academic honesty.

" *Cheating is the giving, taking, or presenting of information or material by a student that unethically or fraudulently aids oneself or another person on any work which is to be considered in the determination of a grade or the completion of academic requirements or the enhancement of that student's record or academic career."* (NCSU Code of Student Conduct)

Scholarly activity is marked by honesty, fairness and rigor. A scholar does not take credit for the work of others, does not take unfair advantage of others, and does not perform acts that frustrate the scholarly efforts of others. The violation of any of these principles is academic dishonesty. Penalties for a violation: For the first violation, you will receive a zero for your work and be put on academic integrity probation for the remainder of your stay at NCSU. The second violation may result in your suspension from NCSU. Both situations will involve the Office of Student Conduct. See the website for a full explanation:

http://www.ncsu.edu/policies/student_services/student_discipline/POL11.35.1.php

Honor Pledge

Your signature on any test or assignment indicates "I have neither given nor received unauthorized aid on this test or assignment."

Electronically-Hosted Course Components

Students may be required to disclose personally identifiable information to other students in the course, via electronic tools like email or web-postings, where relevant to the course. Examples include online discussions of class topics, and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.

Electronically-hosted Components: Class videos, notes, and other materials; homework assignments; forum discussions.

Accommodations for Disabilities

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the **Disability Resource Office** at Holmes Hall, Suite 304,Campus Box 7509, 919-515-7653 . For more information on NC State's policy on working with students with disabilities, please see the **Academic Accommodations for Students with Disabilities Regulation (REG02.20.01)**

Students with disabilities should additionally contact their instructor about accommodations.

Non-Discrimination Policy

NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at http://policies.ncsu.edu/policy/pol-04-25-05 or http://www.ncsu.edu/equal_op/. Any person who feels that he or she has been the

subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.

Course Schedule

NOTE: The course schedule is subject to change.

MA242.651 10-Week Summer Session 2020

Day-by-day Schedule

Monday	Tuesday	Wednesday	Thursday	Friday
		(May 13) Lecture 1 Lecture 2	(May 14) Lecture 3 Lecture 4 – 1st half	(May 15) Lecture 4 – 2nd half Lecture 5
(May 18) Lecture 6 Lecture 7 – 1st half	(May 19) Lecture 7 – 2nd half Lecture 8	(May 20) Lecture 9 Lecture 10 – part1	(May 21) Lecture 10 – 2nd half Lecture 11	(May 22) Lecture 12 Lecture 13 – 1st half
(May 25) HOLIDAY	(May 26) Lecture 13 – 2nd half Lecture 14	(May 27) Lecture 15 Lecture 16 – 1st half	(May 28) Lecture 16 – 2nd half Lecture 17 - review	(May 29) TEST 1 (2-day window is: 5/28,5/29) Lecture 18

(June 1) Lecture 19 Lecture 20 – 1st half	(June 2) Lecture 20 – 2nd half Lecture 21	(June 3) Lecture 22 Lecture 23 – 1st half	(June 4) Lecture 23 – 2nd half Lecture 24	(June 5) Lecture 25 Lecture 26 – 1st half
(June 8) Lecture 26 – 2nd half Lecture 27	(June 9) Lecture 28 Lecture 29 – 1st half	(June 10) Lecture 29 – 2nd half Lecture 30 – 1st half	(June 11) Lecture 30 – 2nd half Lecture 31 review	(June 12) **TEST 2 (2-day window is: 6/11,6/12)** Lecture 32
(June 15) Lecture 33 Lecture 34 – 1st half	(June 16) Lecture 34 – 2nd half Lecture 35	(June 17) Lecture 36 Lecture 37 – 1st half	(June 18) Lecture 37 – 2nd half Lecture 38	(June 19) Lecture 39 Lecture 40 – 1st half
(June 22) Lecture 40 – 2nd half Lecture 41	(June 23) Lecture 42 Lecture 43 – 1st half	(June 24) Lecture 43 – 2nd half Lecture 44	(June 25) Lecture 45 Lecture 46 – 1st half	(June 26) Lecture 46 – 2nd half Lectures 47 –1st half

(June 29) Lecture 47 – part 3 Lectures 48 Review	(June 30) TEST 3 (2-day window is: 6/29,6/30) Lecture 49	(July 1) Lecture 50 Lecture 51 – 1st half	(July 2) Lecture 51 – 2nd half Lecture 52	(July 3) HOLIDAY
(July 6) Lecture 53 Lecture 54 – 1st half	(July 7) Lecture 54 – 2nd half Lecture 55	(July 8) Lecture 56 Lecture 57 – 1st half	(July 9) Lecture 57 – 2nd half Lecture 58	(July 10) Lecture 59
(July 13) Lecture 60	(July 14) Lecture 62 Review	(July 15) TEST 4 (2-day window is: 7/14,7/15)	(July 16) Lecture 61 Lecture 63 – 1st half	(July 17) Lecture 63 – 2nd half Lecture 64
(July 20) Lecture 65 1st half	(July 21) Lecture 65 2nd half	(July 22) Lecture 66	(July 23) Lecture 67	(July 24) Lecture 68

(July 27) Final Exams – Day 1	(July 28) Final Exams – Day 2		Grades due at 11:59 pm on Thursday 7/30	

List of Topics for the VIDEO LECTURES

Lecture #	Chapter #	Section #	Topic
1		---	Introduction to the course
	1	1	**Begin** Chapter 1: "**Euclidean Geometry in 3-dimensional Space**". Review Cartesian Coordinates in the Plane; Begin study of Cartesian coordinates in **3-dimensional space**.
2	1	2	Begin study of **Vectors** in two and three dimensions
3	1	2	More on vectors; Positions vector representation of a vector
4		---	Brief discussion of Maple
	1	3	Begin study of the **dot product** of 2 vectors **A** and **B**
5	1	3	More on the dot product
	1	4	Begin study of the **cross product** of 2 vectors **A** and **B**
6	1	4	More on the cross product
7	1	4	Example: orthogonal decomposition of vector **A** with respect to vector **B**
	1	5	Equations of **Lines and Planes**
8	1	5	More on equations of Lines and Planes
9	2	1	Begin Chapter 2: "**The Geometry of Curves in Space**" **Vector-valued functions,** limits and continuity

10	2	1	**Differentiating** vector-valued functions, rules of differentiation, **definite integrals** of vector-valued functions
11	2	1	Sketching curves in 3-d using **Maple** **Anti-derivatives** of vector-valued function, parameterized curves
		2	**Parametrized curves** in space, Introduction to the idea of **curvature,** reparametrizing a curve in terms of **arc length,** Initial-value problems, Application: **Newton's second law** and motion under gravity
12	2	2	Example of motion under gravity
		3	Begin section 3: "*Fundamental Quantities Associated with a Curve*", **Smooth curve**, principal tangent vector to a curve, **unit tangent vector,** velocity, speed and acceleration of a point particle
13	2	3	Arc length of a curve, arc length reparametrization of a curve, **Curvature** of a curve
14	2	2	Exercise #23, section 2.2,
		3	The curvature of a circle of radius R is K = 1/R, curvature of a curve in terms of an arbitrary parameter
15	2	4	The **Unit Normal** Vector N,The **osculating plane**, **Theorem**: Acceleration vector is always parallel to the osculating plane. $\vec{a}(t) = \frac{dv}{dt}(t)\widehat{T}(t) + \kappa(t)v^2(t)\widehat{N}(t)$ The **Unit Binormal** vector B
16	2	4	The **osculating circle** of a curve, instantaneous linear and instantaneous centripetal acceleration, **simple formulas** for the tangential and normal components of acceleration, and for curvature.
17			**Review for Test #1**
Test #1 on chapters 1 and 2			
18	3	1	Begin Chapter 2: "**Differential Multivariable Calculus**" Definition and graphical representation; **Level curves** of f(x,y); **Quadric surfaces**;

19	3	1	Review level curves of f(x,y); **Level surfaces** of f(x,y,z), examples of level surfaces of functions of 3 variables.
20	3	1	Examples of: **Ellipsoids, paraboloids, cones, planes and cylinders;**
		2	**Limits** of multivariable functions; theorems on limits
21	3	2	**Continuity** of multivariable functions; theorems on continuity
		3	Begin **Directional Derivatives** of multivariable functions
22	3	3	x-, y- and z-**partial derivatives; higher partial derivatives**; new notation for partial derivatives
23	3	3	**Geometrical interpretation** of x- and y-partial derivatives of f(x,y). Tangent planes to the graph of f(x,y); **Linearization** of a function near a point
24	3	4	**Differentiability** of multivariable functions; examples; **Theorem**: a multivariable function is continuous at P if it is differentiable at P.
25	3	4	**Theorem**: A multivariable function is differentiable at P if its partial derivatives are continuous at P. Examples: Use the theorem to prove that a function is differentiable at a point.
		5	The **directional derivative** and the **Gradient of a function**. Examples.
26	3	5	What does the gradient of the function f tell us about f? **Tangent planes to level surfaces** of a function f(x,y,z).
27	3	5	The **chain rule**s for multivariable functions; Parametrizing functions that are graphs of functions; **Implicit differentiation**
28	3	6	**Optimization** of function of two variables: finding **local extreme values** of f(x,y); Examples
29	3	6	The **second derivative test;** examples
30	3	6	**Global extreme values of f(x,y)** on closed and bounded sets
31			**Review of chapter 3 for test #2**
Test #2 on chapter 3			
32	4	1	Begin Chapter 4: "**Double and Triple Integrals in Cartesian Coordinates**". Start with **double integrals** over rectangles.
33	4	1	Fubini's Theorem for rectangles. Examples.
34	4	1	Type I regions. **Fubini's theorem for Type I regions**. Examples.

35	4	1	Type II regions. **Fubini's theorem for Type II regions**. Examples.
36	4	1	Reversing the order of integration; Numerous examples
37	4	2	**Applications of double integrals**: area; average values; volume between two surfaces; moments and center of mass of plane laminas,
38	4	2	More on applications of double integrals
39	4	3	**Triple integrals in Cartesian Coordinates**
40	4	3	More on triple integrals: z-simple, x-simple, and y-simple regions;
41	4	3	More examples of triple integrals
42	4	3	**Applications of triple integrals**: Volume; average value; mass and charge density; energy density; moments of inertia
43	5	1	Begin Chapter 5: **Double and Triple Integrals in Curvilinear Coordinates**. Begin with **double integrals in polar coordinates**
44	5	1	Examples of double integrals in polar coordinates
45	5	2	**Triple integrals in cylindrical coordinates**
46	5	3	**Triple integrals in spherical coordinates**
47	5	3	More on triple integrals in spherical coordinates; Examples
48			**Review of chapters 4 and 5 for test #3**
Test #3 on chapters 4 & 5			
49	6	1	Begin Chapter 4: "**Line and Surface Integrals**". Start with **vector fields** in space. Numerous examples.
50	6	2	**Line integrals of functions**.
51	6	2	Solutions to selected exercises in Section 6.2.1 on Line integrals of functions
52	6	3	**Line integrals of vector fields.** Work and other examples
53	6	3	The **Fundamental Theorem** for Line Integrals; Line integrals of vector fields that are **independent of path.**
54	6	3	Characterizing **conservative vector fields**. Finding potential functions for conservative vector fields
55	6	3	More on finding potential functions; Conservation of total energy forNewtonian motion under a conservative force.
		4	**Parametric surfaces** in space
56	6	4	Parametrizing surfaces that are graphs of functions of two variables
57	6	5	**Surface integrals**; **surface area** of a parametrized surface; example: surface area of a sphere
58	6	5	**Surface integrals of functions**; examples
59	6	5	**Surface integrals of vector fields;** examples
60	6	5	More examples of flux integrals

62			**Review of chapter 6 for test #4**
Test #4 on chapter 6			
61	7	1	Begin Chapter 7: "**Vector Analysis**". Start with **integral curves of vector fields** in space.
		2	Differentiating vector fields: The **divergence and curl**.
63	7	2	The concept of "**flux density**" and its relationship to divergence
64	7	2	Divergence and curl in terms of the **"del" operator**. **Geometrical interpretation** of the divergence and curl of a vector field. A vector field is **conservative** if and only if its curl is zero.
65	7	2	More on the geometrical interpretation of curl and divergence
		3	**Green's theorems** for both circulation and flux. Examples
66	7	4	**Stokes' Theorem.** Examples
67	7	5	The **Divergence Theorem** of Gauss – begin with review of Green's theorem for flux.
68	7	6,7	Semester Review
Comprehensive Final Exam			