Course Syllabus

CALCULUS III (Math 253)

Description:	*A continuation of MATH 132. Topics include conic sections, vector algebra, space curves, calculus of functions of several variables, multiple integration, calculus of vector fields. Prerequisite: Grade of C- or higher in MATH 132.*
Credit Hours:	4
Audience:	Required for many STEM majors; prerequisite for MATH 330, 334, 452; MET 369, 372, 435; PHYS 246, 250, 345, 371, 381; ECE 430; ME 362, 405.
Prerequisites:	Grade of C- or better in MATH 132
Format:	4 lectures (50 min) per week
Textbook:	The open educational resource (OER), i.e. free etextbook, for this course is *OpenStax Calculus: Volume 3* located at: https://openstax.org/details/books/calculus-volume-3 (Required). Homework for this course is through the online system WeBWork. There is a $25 fee for WeBWork in lieu of a textbook fee for the course.
Software:	Use of *Maple* is recommended (available on campus computers; purchase of student version is recommended).
Internet:	Course material and grades are maintained in Blackboard
Access & Accommodations:	The Access & Accommodations Resource Center (AARC) is the campus office that works with students to provide access and accommodations in cases of diagnosed mental or emotional health issues, attentional or learning disabilities, vision or hearing limitations, chronic diseases, or allergies. You can contact the office at aarc@valpo.edu or 219.464.5206. Students who need, or think they may need, accommodations due to a diagnosis, or who think they have a diagnosis, are invited to contact AARC to arrange a confidential discussion with the AARC office. Further, students who are registered with AARC are required to contact their professor(s) if they wish to exercise the accommodations outlined in their letter from the AARC.
Emergencies:	VU's Emergency Notification System (ENS) uses multiple forms of communication, including e-mail, building alarms, outdoor sirens, message boards, computer alerts, Twitter, and public address messaging. Please review the specific procedures for this class found in Blackboard. Remember: "Siren inside, GO outside; Siren outside, GO inside." To evacuate, gather your personal belongings quickly and proceed to the nearest exit. Do not use the elevator. To shelter in place, move away from the windows and stay low to the ground; lock or barricade the door if there is a threat of violence.
Notice of Cancellation:	In the event class is cancelled, you will be notified through your Valparaiso University e-mail account.

Student Learning Objectives:

A. Students can perform algebraic, geometric and technological operations required for success in multivariable and vector calculus.
B. Students understand fundamental concepts of multivariable calculus, and vector algebra and calculus.
C. Students develop and improve analytical thinking for problem solving, both manual and using technology.
D. Students develop a skill-set necessary for success in disciplines which rely on multivariable and vector calculus, and in more advanced mathematical topics such as partial differential equations, complex variables, and real analysis.
E. Students can communicate mathematics effectively, with proper notation and terminology.

Topics & Performance Requirements Include (but are not limited to):

1. identifying domain and range of multivariable or vector-valued functions
2. expressing curves and surfaces with parametric equations
3. finding limits of multivariable functions
4. computing partial derivatives, directional derivatives and gradients
5. constructing and using multivariable chain rule expressions
6. identifying local extremes of real-valued functions of two variables
7. using Lagrange multipliers to find solutions to constrained optimization problems
8. performing double and triple integrals in standard coordinate systems
9. using Fubini's Theorem to change order of integration when appropriate
10. understanding vectors as quantities having length and direction, independent of position
11. performing addition, scalar multiplication, dot product and cross product of vectors
12. recognizing when two vectors are orthogonal and use the normal vector to find the equation for a plane in three-dimensional space
13. finding limits, rates of change, and integrals along space curves
14. computing the unit tangent and unit normal vectors of space curves
15. defining and sketching two- or three-dimensional vector fields
16. computing divergence and curl of vector fields
17. computing the gradient of a function at a point or expressing the gradient function as a vector field
18. using the gradient to determine characteristics of a function, such as min / max rates of change and direction of steepest ascent and descent
19. constructing a tangent plane on a surface, and understanding how the tangent plane can be used as a linear approximation of the function near the point of tangency
20. recognizing conservative vector fields
21. evaluating line and surface integrals over 2D and 3D lines and surfaces
22. understanding when the Fundamental Theorem of Line Integrals applies, and using it to evaluate line integrals when appropriate

23. knowing when Green's Theorem applies and using it to evaluate line integrals when appropriate
24. knowing when Gauss' Divergence Theorem applies and using it to evaluate flux integrals when appropriate
25. knowing when Stokes' Theorem applies and using it to evaluate work integrals when appropriate