Fariborz Maseeh Department of Mathematics and Statistics

MTH 255: Calculus V

Updated Fall 2019

Description: Further study of multiple integrals, line and surface integrals, Greens theorem, Stokes theorem, the Divergence theorem, and applications.

Credits: 4

Prerequisite: Mth 254 with minimum passing grade of C-

Course Objectives: This is the fifth course in the calculus sequence. The course is focused on the development of vector calculus, including Green's theorem, Stokes' theorem, and the Divergence theorem. Applications from the sciences are presented as well.

Student Learning Outcomes: Upon completion of this course students will be able to:

- Apply a change of variables in multiple integrals and use these in applications.
- Compute line and surface integrals and apply them to basic problems in physics and engineering.
- Understand fundamental theorems of vector analysis such as Green's theorem, Stokes' theorem, and the Divergence theorem and apply them to problems of integral calculus.
- Apply vector analysis to problems in the sciences, including selected applications from physics such as conservation laws, fluid dynamics, heat, and diffusion.

Topics:

1. *Multiple Integration:* Triple integrals, integration in polar, cylindrical, and spherical coordinates, change of variable.
2. *Line and Surface Integrals:* Vector fields, line integrals, conservative vector fields, parametrized surfaces and surface integrals, surface Integrals of vector fields.
3. *Fundamental Theorems of Vector Analysis:* Green's theorem, Stokes' theorem, Divergence theorem.
4. A*pplications to Physics and Mechanics:* Conservation of mass, energy, heat equation, advection diffusion, fluid dynamics, Euler's equations.

Suggested Text:

Jon Rogawski and Colin Adams*, Calculus: Early Transcendentals*, 3rd ed., Freeman, W.H.& Company 2015.

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Current MTH 255 Textbook Mapping:

Jon Rogawski and Colin Adams*, Calculus: Early Transcendentals*, 3rd ed., Freeman, W.H.& Company 2015.

15 Multiple Integration

15.3 Triple Integrals (Review)
15.4 Integration in Polar, Cylindrical, and Spherical Coordinates (Review)
15.5 Applications of Multiple Integrals
15.6 Change of Variables

16 Line and Surface Integrals

16.1 Vector Fields
16.2 Line Integrals
16.3 Conservative Vector Fields
16.4 Parametrized Surfaces and Surface Integrals
16.5 Surface Integrals of Vector Fields

17 Fundamental Theorems of Vector Analysis

17.1 Greens Theorem
17.2 Stokes Theorem
17.3 Divergence Theorem

18 Applications to Physics and Mechanics

Conservation Laws:
Conservation of mass
Continuity equation
Conservation of energy
Heat equation
Advection-diffusion
Fluid dynamics: conservation of mass and momentum
Euler's equations