Course Change Request

New Course Proposal

Date Submitted: 03/23/22 11:00 am

Viewing: MATH 432 : Differential Geometry

Last edit: 04/01/22 8:56 am

Changes proposed by: csausvil

In Workflow

1. **MATH Chair**
2. **SC Curriculum Committee**
3. SC Associate Dean
4. Assoc Provost-Undergraduate
5. Registrar-Courses
6. Banner

Approval Path

1. 03/23/22 11:07 am Maria Emelianenko (memelian): Approved for MATH Chair

Are you completing this form on someone else's behalf?

No

Effective Term: Fall 2022

Subject Code: MATH - Mathematics

Course Number: 432

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: Differential Geometry

Banner Title: Differential Geometry

Will section titles vary by semester? No

Credits: 3

Schedule Type: Lecture

Hours of Lecture or Seminar per week: 3

Repeatable:

May be only taken once for credit, limited to 3 attempts (N3)

Max Allowable Credits: 9

Default Grade Mode: Undergraduate Regular

Recommended Prerequisite(s):

Recommended Corequisite(s):

Required Prerequisite(s) / Corequisite(s) (Updates only):

C or better in Math 315

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(	Course/Test Code	Min Grade/Score	Academic Level	)	Concurrency?

Registration Restrictions (Updates only):

Registrar's Office Use Only - Registration Restrictions:

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog Description:

Explores the geometry of curves and surfaces, with a focus on differential (smooth) spaces. Students will explore precise characterizations of length of curves, curvature, dimension, and vector fields on curves and surfaces. Additional topics may include the geometry of the Gauss Map, intrinsic and extrinsic properties of curves and surfaces, and the Gauss-Bonet Theorem.

Justification:

What: Creating a new course, Differential Geometry.

Why: We are looking to expand our upper division course offerings in pure mathematics. This will also support a potential future concentration in pure mathematics for the Mathematical Sciences BS degree.

Does this course cover material which crosses into another department? No

Learning Outcomes:

1. Students will learn to read and write proofs in the subject of differential geometry.
2. Students will learn to present advanced mathematical material.
3. Students will learn to do computations using differential data.
4. Students will learn to visualize mathematical concepts.
5. Students will learn how to do calculus on curves and surfaces

Attach Syllabus

DGSyllabus-Generic-New.pdf

Additional Attachments

Staffing:

Potential faculty for this course include, but are not limited to, Anton Lukyanenko, David Carchedi, Rebecca Goldin, Sean Lawton, and Tyrus Berry.

Relationship to Existing Programs:

This course would expand the offerings of the Mathematics BS degree.

Relationship to Existing Courses:

To our knowledge are no other similar courses at the university.

Additional Comments:

Reviewer Comments

Key: 17598

Department of Mathematical Sciences

General Syllabus

Differential Geometry

Proposed Course Number: MATH 432

Suggested Texts:

1. *Elementary Differential Geometry,* Revised 2nd Edition, by Barrett O'Neill, ISBN-13: 978-0120887354
2. *Differential Geometry of Curves and Surfaces,* by M. do Carmo, ISBN: 9780486806990

Recommended Prerequisites: Math 315

General Description: This introduction to differential geometry is the study of the geometry of curves, and surfaces in real 3 dimensional space. Both intrinsic and extrinsic methods are developed. Topics like length, geodesics, curvature, and vector fields will be taught. Highlights include the Gauss-Bonnet Theorem and Gauss' Theorema Egregium.

(Catalog) Description: Explores the geometry of curves and surfaces, with a focus on differential (smooth) spaces. Students will explore precise characterizations of length of curves, curvature, dimension, and vector fields on curves and surfaces. Additional topics may include the geometry of the Gauss Map, intrinsic and extrinsic properties of curves and surfaces, and the Gauss-Bonet Theorem.

Learning Objectives:

1. Students will learn to read and write proofs in the subject of differential geometry.
2. Students will learn to present advanced mathematical material.
3. Students will learn to do computations using differential data.
4. Students will learn to visualize mathematical concepts.
5. Students will learn how to do calculus on curves and surfaces.

Assessment: Students will be assessed on homework, presentations, projects, or exams. These will be determined by the instructor.

Grading: Possible grading scale: A: 90-100%; B: 80-89%; C: 70-79%; D: 60-69%; F: below 60% . + or – *may* be attached to the grade for the upper or lower 2 points in each range.

Electronic Devices (such as laptops, cell phones, etc.)**:** Please be respectful of your peers and your instructor and do not engage in activities that are unrelated to class. Such disruptions show a lack of professionalism and may result *penalties.*

Disabilities: Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University.

All academic accommodations must be arranged through that office. It is the student's responsibility to get exam accommodation forms signed and turned in at least one week before the exams.

If you are seeking accommodations, please visit https://ds.gmu.edu/ for detailed information, or email: ods@gmu.edu.

Academic Integrity: It is expected that students adhere to the George Mason University Honor Code as it relates to integrity regarding coursework and grades. The Honor Code reads as follows:

To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the University Community have set forth this: Student members of the George Mason University community pledge not to cheat, plagiarize, steal and/or lie in matters related to academic work.

More information about the Honor Code, including definitions of cheating, lying, and plagiarism, can be found at the Office of Academic Integrity website at: https://oai.gmu.edu.

Diversity: In this course, we seek to create a learning environment that fosters respect for people across identities. We welcome and value individuals and their differences, including gender expression and identity, race, economic status, sex, sexuality, ethnicity, national origin, first language, religion, age and ability. We encourage all members of the learning environment to engage with the material personally, but to also be open to exploring and learning from experiences different than their own. See the following URL for more information:

https://stearnscenter.gmu.edu/knowledge-center/general-teaching-resources/mason-diversity-statement/

Privacy: Students must use their GMU email account to receive important University information, including messages related to this class. *I will not correspond to anyone in this course over email if they do not use their official GMU email.*

Week by Week:

Date	Lecture Topic
Week 1	Parametrized Curves, Regular Curves and Arclength
Week 2	Local and Global Theory of Curves

Week 3	Regular Surfaces and Regular Values
Week 4	Tangent Plane, Cotangent Plane, and Differential of a Map
Week 5	First Fundamental Form
Week 6	Orientation and Characterization of Compact Orientable Surfaces
Week 7	The Gauss Map, Second Fundamental Form & Curvature
Week 8	Vector and Covector Fields
Week 9	Isometries and Conformal Maps
Week 10	Gauss Theorema Egregium
Week 11	Parallel Transport, Covariant Derivative, & Geodesics
Week 12	The Gauss-Bonnet Theorem
Week 13	Sphere Rigidity
Week 14	Hopf-Rinow Theorem