Columbia University: Arts & Sciences
A&S Spring 2025 Standard Evaluation

Course: MATHGR6403_001_2025_1 - MODERN GEOMETRY: MATHG6403_001_2025_1_208363
Instructor: Elena Giorgi *
TA: Zongrui Yang
Response Rate: 10/14 (71.43 %)

1 - What did you learn - in terms of knowledge, skills, or perspectives - in this course?The answer to this question will generally be available in Vergil.

Response Rate	6/14 (42.86%)

- Jacobi fields, second fundamental form, embeddings of manifolds, spaces of constant sectional curvature, variations of energy, mathematical GR -- Schwarzschild, Kerr black holes, trapped surfaces.
- Jacobi Fields, Second fundamental forms, Hadamard, Variations, and most fun, General Relativity.
- In this class we studied Jacobi fields, isometric immersions, completeness of Riemannian manifolds, spaces of constant curvature, and variations of energy of curves. We also got a crash course introduction to mathematical General Relativity, regarding the initial value formulation of the Einstein field equations, the causal structure of spacetime, null-structure equations, black holes, and wave -equations/energy estimates on black hole spacetimes.
- Applying the concepts of connections and curvature of Riemannian manifolds studied in the first semester of this course. Jacobi Fields, Isometric Immersions, Geodesically Complete Manifolds, Spaces of Constant Curvature, Variations of Energy. The class also ended with an overview of Mathematical GR.
- I continued to learn about the modern theory of geometry, particularly covering chapters 6-9 in do Carmo's book on Riemannian geometry and some additional content on mathematical GR.
- Jacobi fields, isometric immersions (second fundamental form and fundamental equations), Hopf-Rinow and Hadamard Theorem, spaces of constant curvature, variations of energy, Bonnet-Meyers and Synge-Weinstein, and general relativity (existence of black holes, null-structure equations, Kerr black holes)

2 - What percentage of the work (including reading) assigned for this course did you complete on schedule?

Response Option	Weight	Frequency	Percent	Percent Responses	Means
All or almost all	(1)	7	70.00%		
Most	(2)	2	20.00%		
Some	(3)	1	10.00%		
This question is not applicable	(4)	0	0.00%		

0 25 50 100

Response Rate
10/14 (71.43%)

3 - What is your overall assessment of the course? What are its strengths? In what ways might it be improved? In answering this question, you might address the value of readings and assignments, the structure of the course (including the relationship of sections to lectures), the contribution of the course to your knowledge of the subject matter and to the development of your analytical and reasoning skills, etc. We encourage you to use specific examples where possible.

Response Rate	4/14 (28.57%)

- It was a great course, and I felt that it very much reinforced the important aspects of Riemannian geometry, especially with showing new methods to approach curvature of all types on many different types of manifolds. I do wish there was even more on general relativity, although maybe that should have its own graduate seminar course some day! I'm certain many of the students this semester would enjoy that as well.
- Readings are standard and fun!
- Modern Goemetry II is an excellent continuation to the first semester where the mechanisms built up in the first semester are put to use. After the main material was completed, an overview of Mathematical GR was done which again made extensive use of the material taught in both semesters, providing a great introduction to a field of active research. An improvement to the class which could be made spend less time on the earlier topics so that more weeks could could be spent on GR since it was by far more the most interesting and difficult thing on the syllabus.
- The course, while standard, did not disappoint much in its covering of content; the only gripe I had was that too little time was given to the discussion of mathematical GR which, while rushed, was still the most interesting part of the course overall.

4 - What is your overall assessment of the course?The answer to this question will generally be available in Vergil.

Response Option	Weight	Frequency	Percent	Percent Responses	Means
Excellent	(5)	8	80.00%		4.80
Very Good	(4)	2	20.00%		
Good	(3)	0	0.00%		
Fair	(2)	0	0.00%		
Poor	(1)	0	0.00%		

0 25 50 100 Question

Response Rate	Mean	STD	Median
10/14 (71.43%)	4.80	0.42	5.00

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5 - Would you recommend this course to another student?The answer to this question will generally be available in Vergil.

Response Option	Weight	Frequency	Percent	Percent Responses	Means
Definitely recommend	(1)	8	80.00%		
Probably recommend	(2)	2	20.00%		
I'm not sure I'd recommend	(3)	0	0.00%		
Probably not recommend	(4)	0	0.00%		
Definitely not recommend	(5)	0	0.00%		

0 25 50 100

Response Rate
10/14 (71.43%)

6 - Please qualify your recommendations if you wish:The answer to this question will generally be available in Vergil.

Response Rate	3/14 (21.43%)

- Great course, engaging lectures, and covered many topics that extended the results and foundations covered in semester one.
- Prof. Giorgi gives excellent lectures and very clear presentations! Both the material delivery is clear and the overall course design is reasonable. I recommend anyone interested in geometry to take her class.
- This course is quintessential for anyone interested in geometry and/or geometric analysis, but is also broad enough for people of lots of different backgrounds to join. For instance physicists interested in understanding (semi)-Riemannian geometry or vector bundles. If Prof. Giorgi is teaching it, the last few lectures on General Relativity are very exciting as you get to see some of the things that felt like 'pure' geometry (Jacobi fields) help you study physical processes (trapped surfaces). I would also advise this course to anyone interested in PDE, as it will give inspiration to many interesting geometric PDE (such as the minimal surface equation), and especially hyperbolic PDE from the General Relativity section .

7 - How does the workload in this course compare to Columbia courses with a similar structure (e.g. a lecture, seminar, laboratory, or language course)?The answer to this question will generally be available in Vergil.

Response Option	Weight	Frequency	Percent	Percent Responses	Means
Much heavier workload	(1)	0	0.00%		
Heavier workload	(2)	1	10.00%		
Similar workload	(3)	8	80.00%		
Lighter workload	(4)	1	10.00%		
Much lighter workload	(5)	0	0.00%		
No basis for comparison	(6)	0	0.00%		

0 25 50 100

Response Rate
10/14 (71.43%)

8 - How many hours a week did you devote to this course? (Note: Please include all time spent on this class including class time, discussion sections, readings, assignments, studying, etc.)The answer to this question will generally be available in Vergil.

Response Rate	4/14 (28.57%)

- 4-6
- 5
- 10
- ~4-6

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9 - Please evaluate Elena Giorgi. What are Elena Giorgi's strengths? In what ways might their teaching be improved? In answering this question, you might address the clarity of the lectures or presentations and their relationship to the other elements of the course, the ability of Elena Giorgi to generate enthusiasm and facilitate discussion, the quality of feedback, availability, the timeliness of the return assignment, etc. -

Response Rate	6/14 (42.86%)

• Fantastic professor! Lectures were consistently engaging, and the coverage of mathematical GR was especially exciting. I think a dedicated course on math-GR would be great in the future, both for students and the lectures, since the lectures on this subject were especially great. Everyone always seemed very engaged, and she communicated everything very clearly throughout all parts of the course.

• She is extremely friendly and enthusiastic about her career and teaching materials. You learn a lot from the detailed arguments! and amazing drawings.

• Prof. Giorgi is a fantastic professor! She explains every new concept with many examples, and it seems like everyone is able to follow along with the material. Her exams were definitely fair, and her excitement about the General Relativity portion of the class made it much easier to follow even if it was closer to the end of the course. I'm sure people understand how to use Jacobi fields, study immersed sub-manifolds, and study variations of geodesics as a consequence of her teaching.

• Professor Giorgi's style of teaching is excellent for students to deeply grasp the topics and she often supplements he board work with drawings that paint a good conceptual picture about the otherwise abstract topics. She is also willing to sit down with students to clarify their doubts and even encourages students to meet her post-midterms so that we can better understand our mistakes and she can better understand our work. If there is anything to be improved on, I think she began the semester being a little too concerned with being 'pedantic' and so the topics were covered more slowly with less breadth than what one expects from a graduate course. However, when reaching the section on Mathematical GR, the material was suddenly covered much more quickly. Once again, I think this could be improved by balancing the pace throughout the semester a little better.

• Prof. Giorgi is a solid lecturer who explained all the content in a clear and concise fashion. Her lectures included examples as appropriate to illustrate the more abstract ideas we were working with, while her exams were well designed to test you on the fundamental notions being encountered in class. She was also helpful and reasonable in office hours. Lastly, when we did eventually arrive at the most exciting topic of GR, her deep knowledge of the subject was readily apparent, as she gave a unique perspective on the subject.

• She teaches in a very clear manner and explains the details very well. Topics feel very motivated and lectures were well-structured.

10 - What is the overall teaching effectiveness of Elena Giorgi? -

Response Option	Weight	Frequency	Percent	Percent Responses	Means
Excellent	(5)	10	100.00%		5.00
Very Good	(4)	0	0.00%		
Good	(3)	0	0.00%		
Fair	(2)	0	0.00%		
Poor	(1)	0	0.00%		
				0 25 50 100	Question

Response Rate	Mean	STD	Median
10/14 (71.43%)	5.00	0.00	5.00

11 - What are the strengths and weaknesses of Zongrui Yang (discussion section leader, lab section leader, grader) as an instructor, and how might Zongrui Yang's teaching be improved?

Response Rate	1/14 (7.14%)

• I can't comment on teaching skills; I do wish assignments had been graded slightly sooner, but that is not a big point of complaint for a course structured in the way of this one.

12 - What is the overall teaching effectiveness of Zongrui Yang?

Response Option	Weight	Frequency	Percent	Percent Responses	Means
Excellent	(5)	5	62.50%		4.63
Very Good	(4)	3	37.50%		
Good	(3)	0	0.00%		
Fair	(2)	0	0.00%		
Poor	(1)	0	0.00%		
				0 25 50 100	Question

Response Rate	Mean	STD	Median
8/14 (57.14%)	4.63	0.52	5.00