MTG6257/MAT4930 SYLLABUS - SPRING, 2020

Lecture Times and Location: MWF period 8, Little Hall, Room 217

Instructor: Luca F. Di Cerbo
https://people.clas.ufl.edu/ldicerbo/

Instructor's Office: Little Hall 476

Office Hours: Wednesday 9th Period (4:05 - 4:55 pm), Thursday 3rd and 4th Period (9:35 - 11:30 am), and by appointment.

Instructor's Email: ldicerbo@ufl.edu

COURSE TITLE: Differential Geometry 2.

PREREQUISITES: Calculus III, Linear Algebra, and Basic Topology.

COURSE OBJECTIVES

We will continue the study of modern Differential and Riemannian Geometry. You will be able to communicate such concepts in writing and through short oral presentations. This course will expose you to modern graduate level mathematics which also plays an important role in theoretical physics, such as General Relativity and String Theory.

MAIN TEXTBOOKS

- Manfredo P. do Carmo, Riemannian Geometry. Mathematics: Theory & Applications. Birkhäuser Boston, Inc., Boston, MA, 1992.
- Isaac Chavel, Eigenvalues in Riemannian Geometry. Pure and Applied Mathematics, 115. Academic Press, Inc., Orlando, FL, 1984.

Other References

- John Milnor. Curvatures of left invariant metrics on Lie groups. Advances in Math. 21 (1976), no. 3, 293–329.
- Shing-Tung Yau. Some function-theoretic properties of complete Riemannian manifold and their applications to geometry. Indiana Univ. Math. J. 25 (1976), no. 7, 659–670.
- Peter Petersen, Riemannian Geometry. Third edition. Graduate Texts in Mathematics, 171. Springer, Cham, 2016.

COURSE DESCRIPTION

Below is a list of topics we will be covering.

Riemann Curvature tensor and Bianchi Identities. Main Notions of Curvature: Sectional, Ricci, and Scalar. Curvature of left invariant metrics on Lie groups (following J. Milnor). Jacobi fields, Conjugate Points, and Klingenberg Lemma. Second Fundamental Form of a Riemannian Submanifold, Hopf-Rinow Theorem, and the Theorem of Hadamard. The theorems of Bonnet-Myers and Synge-Weinstein. Green's Formulas and Laplacian on Manifolds. Harmonic functions on complete manifolds (following S.-T. Yau). Fundamental group of manifolds of negative curvature.

We will cover the material from **Chapters 5, 6, 7, 9, 12** of the Main Textbook (Riemannian Geometry, by do Carmo). Tentatively we will also cover some aspects of the research papers by Milnor and Yau listed above under "Other References".

COURSE SCHEDULE

We will follow the progression of topics listed in the "Course Description" section. This corresponds to Chapters 0 - 7 in the main reference book. Roughly, this is the weekly schedule

- Week 1 3: Chapter 4 and Curvature of Left Invariant Metrics on Lie Groups;
- Weeks 4 5: Chapters 5;
- Weeks 5 7: Chapter 6;
- Weeks 8 9: Chapter 7;
- Weeks 9 10: Chapter 9;
- Weeks 11 12: Laplacian on Manifolds and Harmonic Functions;
- Weeks 13 14: Chapter 12;
- Weeks 15: Chapter 12.

The course schedule is subject to adjustments depending on my interaction with the audience. In particular, we may skip the topics of weeks 11 - 12 if we are running out of time.

ATTENDANCE POLICY, CLASS EXPECTATIONS, and MAKE-UP POLICY

I consider attendance very important. Excused absences must be consistent with university policies in the Graduate Catalog and require appropriate documentation. Additional information can be found here:

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https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.
aspx

EVALUATION OF GRADES

- Homework, and attendance (60%).
- Final presentations (40%). The date and format are to be determined.

GRADING POLICY

A: 90% - 100%, A-: 85% - 89%, B+: 80% - 84%, B: 75% - 79%, B-: 70% - 74%, C+: 65% - 69%, C: 60% - 64%, D+: 57% - 59%, D: 54% - 56%, D-: 50% - 53%, E: 0% - 49%.

STUDENTS REQUIRING ACCOMMODATIONS

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso. ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

COURSE EVALUATIONS

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa. ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https: //ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

UNIVERSITY HONESTY POLICY

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code:

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(https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/)

specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

STUDENT PRIVACY

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There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see:

http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html

CAMPUS RESOURCES

Health and Wellness

U Matter, We Care:

If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: http://www.counseling.ufl.edu/ cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS), Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

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Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus: https://www.dso.ufl.edu/documents/ UF_Complaints_policy.pdf.

On-Line Students Complaints:

http://www.distance.ufl.edu/student-complaint-process.