Math 549 **Geometric Structures: Complex Manifolds** **Spring 2019**

SYLLABUS

Lectures: MWF 1:30–2:20
Padelford C-401

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Course Web site: www.math.washington.edu/~lee/Courses/549-2019/

Prerequisites: Topology, smooth manifolds, Riemannian geometry, vector bundles, and undergraduate complex analysis.

Course outline: I hope to cover the following topics:

- Definition and examples of complex manifolds
- Almost complex structures and integrability
- Holomorphic vector bundles
- Line bundles and hypersurfaces
- Hermitian connections
- Hermitian and Kähler metrics
- Kähler-Einstein metrics and Calabi-Yau manifolds
- Sheaves and cohomology
- Hodge theory
- The Kodaira embedding theorem

Books:
There will be no official textbook for this course. Instead, I'll be drawing material from the following books, all of which are either available for download through the UW Libraries website, or on reserve in the Math Research Library.

- Werner Ballmann, *Lectures on Kahler Manifolds*, European Mathematical Society, 2006.
- Phillip Griffiths and Joseph Harris, *Principles of Algebraic Geometry*, Wiley, 1994.
- Daniel Huybrechts, *Complex Geometry: An Introduction*, Springer, 2005.
- Andrei Moroianu, *Lectures on Kähler Geometry*, Cambridge, 2007.
- Raymond O. Wells, Jr., *Differential Analysis on Complex Manifolds*, 3rd ed., Springer, 2008.
- Fangyang Zheng, *Complex differential geometry*, AMS, 2000.

Homework:
Problem sets will be assigned at irregular intervals, usually every two weeks or so. When you write them up, please follow the following guidelines:

- **Collaboration:** I strongly encourage you to work with other students on the homework. You'll get the most benefit from working with others if you make a good faith effort to solve the problems on your own first; but once you've thought about them for a while, I don't mind if you ask each other for explanations of how to do the problems. When writing up solutions to hand in, *you must write your own solutions in your own words.*

- **Problem Statements:** You need not copy the entire problem statement, but be sure to state clearly what you're proving. I prefer that you state each result in the form of a theorem (e.g., "**Theorem:** Every flabby sheaf is soft") instead of a command ("Prove that every flabby sheaf is soft") or a question ("Is every flabby sheaf soft?").

- **Assembly:** Arrange your solutions in numerical order, just as they appear on the assignment page, with each problem starting on a new page. Problems that are out of order might not get credit. Please staple the pages of each assignment together.

- **Identification:** Make sure the first page of each homework packet is clearly labeled with your name and the assignment number.

- **Typesetting vs. handwriting:** I strongly encourage you to submit computer-typeset assignments. I recommend LaTeX, since it's the de facto standard in mathematics, and you'll have to learn it sooner or later if you continue doing math research or teaching; but any typesetting program will do. I've posted some helpful typesetting links on the class web page. I'm also happy to accept handwritten assignments, as long as they are neat and legible (see below).

- **Legibility:** If you write by hand, write your answers neatly and legibly, not too small, with as few erasures or crossouts as possible. Be sure to distinguish clearly between similar symbols, such as a/α, $b/6$, $C/\subset$, $\in/\varepsilon$, $g/q/9$, h/n, $I/l/1$, p/ρ, r/γ, $s/5$, $t/+$, $u/v/\nu$, $U/\cup$, $x/\times/\chi$, $y/4$, $z/2$, ζ/ξ, and uppercase/lowercase letters. Unless mathematical ideas spring fully and impeccably realized from your pen, your first draft is not acceptable.

- **White space:** Don't be stingy with white space. *Leave one-inch margins on all four sides of your pages.* If you don't, I'll be annoyed because I don't have room to write comments, and you don't want your paper being graded by an annoyed reader!

Grading:
Your grade will be based on homework; there are no exams. Roughly speaking, the cutoff for a 4.0 will be somewhere around 80%, and the cutoff for a 3.0 somewhere around 50%.

If you wish, you may register for this course on an S/NS basis (for example, if you have passed prelims and chosen a PhD committee, and are therefore no longer required to register for graded courses). In this case, if you attend regularly and hand in at least two correct written problem solutions, I will record your grade as a 2.7, which will be converted by the registrar to S (satisfactory).