Math 582A	Introduction to Bundles	Winter 2024
	SYLLABUS	

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

Instructor: Jack Lee
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Course Websites: www.math.washington.edu/~lee/Courses/582-2024
                      canvas.uw.edu/courses/1697499

General description:
This course is about topological and geometric properties of bundles of all types. Topics will include vector bundles, fiber bundles, structure groups, principal bundles, associated bundles, classifying spaces, characteristic classes, connections, flat connections and representations of the fundamental group, Chern-Weil theory, the Chern-Gauss-Bonnet theorem, and (if there's time) spin bundles and elementary sheaf theory.

Text:
The text for the course will be the following draft book in progress:

- [IB] John M. Lee, *Introduction to Bundles*, draft edition, winter 2024.

It will be available for download on Canvas. I will be updating it periodically as the quarter progresses. I'll be sure to make an announcement on Canvas whenever it's updated, so you can be sure to download the latest version.

Prerequisites:
Mathematics 544/545/546/547; specifically, the material in my books *Introduction to Topological Manifolds* [ITM], *Introduction to Smooth Manifolds* [ISM], and *Introduction to Riemannian Manifolds* [IRM]. A basic acquaintance with algebraic topology (homology, cohomology, and homotopy groups) will also be useful.

Lectures:
My lectures will be intended to supplement the text, and to help guide you as to how to think about the concepts, rather than just repeating what's in the text. I don't recommend skipping them.

Homework:
I'll assign problem sets approximately every couple of weeks. You should do all the assigned reading, and try to figure out how to do all the *Exercises* included in the text, whether assigned or not. The problems listed as "to write up and hand in" are to be submitted via Canvas for grading, no later than midnight on the due date. If you must turn in an assignment late due to medical or other compelling reasons, please contact me in advance, or as soon as medically possible thereafter.

When you write up your solutions, please follow these guidelines:

- **Citing results:** You may freely cite theorems, propositions, corollaries, lemmas, and exercises from earlier in the book, or from the appendix. But (unless I announce otherwise) the result of a *problem* can only be used if it has been previously assigned, or if you give its solution. You may also use anything from [ITM], [ISM], or [IRM], including the results of problems and exercises, unless they are substantially identical to what you're being asked to prove. If you look up and use something proved in any other book or on the internet, please explain what you found and where you found it, and write up a proof in your own words of any result that you need to use to solve a homework problem. Do not look up specific solutions to the assigned problems, and do not copy specific language that anyone else has written.

- **Collaboration:** I strongly encourage you to work with other students on the homework. Discussing problems and ideas with your classmates is one of the best ways to absorb new ideas. But when writing up solutions to hand in, you must *write your own solutions in your own words.*

- **Writing it up:** Always start by writing the problem number (from the book), and stating what you're going to prove. You don't have to copy the whole problem statement verbatim; often it's better just to state the theorem that you're being asked to prove. Don't be stingy with white space: start each problem on a new page, and leave one-inch margins on all sides of your pages. Arrange your solutions in numerical order, just as they appear on the assignment page. Problems that are out of order might not get credit. I've posted a link on Canvas to an essay I wrote titled "Some Remarks on Writing Mathematical Proofs"; I strongly urge you to read that and follow its advice.

- **Typesetting vs. handwriting:** If you are comfortable doing so, I encourage you to submit computer-typeset assignments. I highly recommend LaTeX, since that is the de facto standard in mathematics; but any typesetting program will do. I've posted some helpful typesetting links on Canvas. 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.

- **Submission:** When you've finished the assignment, create a PDF copy of the assignment and upload it to Canvas. If you need to scan handwritten pages and don't have a regular scanner, try the smartphone app called Genius Scan, which is available free for iPhone and Android.

Religious Accommodations:
Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at *Religious Accommodations Policy* (registrar.washington.edu/staffandfaculty/religious-accommodations-policy/). Accommodations must be requested within the first two weeks of this course using the *Religious Accommodations Request form* (registrar.washington.edu/students/religious-accommodations-request/).

Disability Accommodations:
It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law. If you have already established accommodations with Disability Resources for Students (DRS), please activate your accommodations via myDRS so we can discuss how they will be implemented in this course. If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations, contact DRS at disability.uw.edu.

Grading:
Your grade will be based on the required homework problems; there are no exams. The cutoff for a 4.0 will be approximately 80%, and the cutoff for a 3.0 approximately 50%.

If you don't need to take this course for a numerical grade (e.g., if you've already completed all the required graded course for your degree), you may register for this course on an S/NS basis. You have to make this registration change through MyUW. Be sure to tell me if that's what you're doing. In this case, if you attend lectures regularly and hand in essentially correct written solutions to at least three homework problems taken from three different assignments, I'll record your grade as a 2.7 (for grad students) or 2.0 (for undergrads), which will be converted by the registrar to S (satisfactory).