Math. 489, Sec. 502 Fall, 2005

General Relativity and Tensors

Prerequisites: Linear algebra (Math. 311 or equivalent) and special relativity (Phys. 222 or 309). Intermediate mechanics and electromagnetism courses (Phys. 302 and 304–305) and Math. 412 will be helpful but are not required.

Class time and place: TR 8:00–9:15, Blocker 155

Web page: `http://calclab.math.tamu.edu/~fulling/m489GR`

Instructor: S. A. Fulling
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If I am not in my office, you can leave a note in my mailbox (in the room opposite the Math Department office, 6th floor of Blocker) or in the plastic pouch beside my office door.

Tentative office hours: T 2:00–3:00, WR 3:00–3:45
Permanent office hours will be announced later.

Textbooks:

1. B. F. Schutz, *A First Course in General Relativity* (Cambridge University Press, 1985).
2. R. L. Bishop and S. I. Goldberg, *Tensor Analysis on Manifolds* (Dover, New York, 1980).
3. Old lecture notes and textbook corrections for sale at Copy Corner (2307 Texas Ave. S.).

In addition to covering most of the material in Schutz's relativity book, I'll briefly discuss **gauge field theories** as another application of the concept of a covariant derivative, following Chapter 8 of my book *Aspects of Quantum Field Theory in Curved Space-Time* (Cambridge University Press, 1989). Schutz has very little to say about electromagnetism in relativity, so we will fill in the details as a major homework project.

Grading scheme:

Hour tests:	$125 \times 2 = 250$
Final exam:	200
E&M paper:	50
Other homework and class participation:	100
Total	600

Dates of hour tests: Oct. 6; Nov. 17 (Thursdays)
Final exam: Monday, Dec. 12, 1-3 p.m.
Please bring your own paper for tests.
First draft of electromagnetism paper due Oct. 13; final version due Oct. 27 (Thursdays).
Contract honors students may have additional grading components and deadlines.

First homework assignment: Chapter 1 (p. 30)

High priority: 3, 5, 13, 14, 15, 17

Medium priority: 2, 8, 12, 18, 19, 21

Also: Make a list of the assumptions made (explicitly or implicitly) in the "proof" in Sec. 1.6. (An example of the sort of issue I have in mind here is this: In Sec. 1.5, p. 9, we read that "the event $\mathcal{R}$ on the $\bar{t}$ axis must be as far from the origin as event $\mathcal{E}$." Doesn't this tacitly assume an invariance under time reversal? This is an interesting point for discussion in class.)

Some boiler plate (unnecessary for this audience, I hope)

Make-up tests: Make-up tests are very hard to grade fairly, and they absorb a large amount of my time which would be better spent for the benefit of the whole class. Please cooperate in making these incidents as rare as possible. If you miss (or foresee that you will miss) a test, it is *your* responsibility to contact me as soon as possible to request, justify, and schedule a make-up test. (If you can't reach me directly, you can leave a message at the Math Department office, (409) 845–3261.) If the absence is not clearly excused under the Attendance section of Student Rules, the request may be denied.

An Aggie does not lie, cheat, or steal or tolerate those who do. See Honor Council Rules and Procedures, `http://www.tamu.edu/aggiehonor` .

Plagiarism: Finding information in books or on the Internet is praiseworthy; *lying* (even by silence) about where it came from is academic dishonesty. Whenever you copy from, or "find the answer" in, some other source, *give a footnote or reference*. Otherwise, you are certifying that it is your own work.

Joint work: On a homework assignment (*not* a take-home test!) discussion with other students is permitted, even encouraged. However, you will not get homework credit for "work" that is parasitical (and your test scores will suffer, too!). To forestall problems, please follow these policies: (1) When two or more students work together on an assignment, they should all indicate so on their papers. (2) If the cooperation is of the divide-and-conquer variety, you are certifying that you *have studied and understand* every problem solution on your paper. Mindless copying is dishonest and academically worthless.

Copyright: Course materials (on paper or the Web) should be assumed to be copyrighted by the instructor who wrote them or by the University.

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