An ambitious syllabus

I will follow closely, with some elaboration, the text for the course, *A First Course in General Relativiy* by B. F. Schutz. So, the plan looks like the following:

Introduction

Review of special relativity. Lorentz transformation, length contraction, time dilation and elements of relativistic mechanics. Flat space tensor algebra and calculus.

Tensor Algebra and Calculus

Manifolds, curves, surfaces, tangent vectors, contravariant, covariant and mixed tensors, covariant differentiation, transformation, metrics, the Riemann tensor.

Principles of General Relativity

The principle of equivalence and general covariance

The Einstein-Hilbert Equations

Geodesic deviation, the vacuum and full field equations of general relativity, weak gravitational fields, Newtonian limit.

The Schwarzchild solution

Geodesics in the Schwarzchild spacetime. Experimental and observational tests of general relativity.

Special topics

Non-rotating black holes, relativistic cosmology, cosmological models.

Textbooks

The required textbook for the course is

> *A First Course in General Relativiy* by B. F. Schutz

I will also draw material from the following texts all of which are highly recommended as secondary reading:

Suggested Textbooks

> *Gravity An Introduction to Einstein's General Relativity* by J. Hartle
> *A Short Course in General Relativity* by J. Foster and J. Nightingale
> *General Relativity. An Introduction for Physicists* by M. P. Hobson, G. Efstathiou and A. N. Lasenby

Reading List

Introducing Einstein's Relativity by R. D'Inverno
Relativity: Special, General and Cosmological by W. Rindler
An Introduction to General Relativity by L. P. Hughston and K. P. Tod
Flat and Curved Space-Times by G. F. R. Ellis
Gravitation and Spacetime by H. C. Ohanian
A Problem Book in Relativity and Gravitation by A. P. Lightman
Spacetime and Geometry: An Introduction to General Relavity by Sean Carroll
General Relativity by R. M. Wald
The Classical Theory of Fields by L. Landau and E. Lifshitz
Gravtitation by C. W. Misner, K. S. Thorne, and J. A Wheeler
Gravitation and Cosmology by S. Weinberg
Geometric Methods of Mathematical Physics by B. F. Schutz
Modern Differential Geometry for Physicists by C. J.Isham

Unpopular, but necessary, topics

Homework

There will be weekly homework assignments. Some problems will be marked *solo*, meaning that you are to do the problem by yourself with no interaction with any of your fellow students. For the other, *non-solo* problems you may work in collaboration.

Some advice. Since some GR problems tend to require a lot of calculations, it is wise, in fact, very wise, not to wait until the day before the homework due date to start the assignment.

Exams

The course will have two exams, an in-class midterm and a take home final.

Grading Policy

The homework assignments will count 50% of the final grade and each exam 25%.

Class attendance and participation

I will not take attendance but you are encouraged to attend class regularly and ask questions. GR is not easy but it is fun so being exposed to it from various avenues, such as the textbook and class lectures, can help your understanding of the subject matter. A reminder, PLEASE ASK QUESTIONS.