Some Useful References

The following are some books that you might find useful. The first three have been placed on the two-hour reserve list at the mathematics library (as has Wald).

C.W. Misner, K.S. Thorne, and J.A. Wheeler, *Gravitation*, (W.H. Freeman and Company, New York, 1973) [QC178 .M67]. Although 35 years old, this is still a standard textbook for graduate courses due to its comprehensiveness (over 1000 pages!). It is particularly strong on how general relativity meshes with the rest of physics, on physical intuition, and on applications to astrophysics. It is packed with examples and problems and historical notes, and contains here and there details not found any other book, although some of the applications like cosmology are out of date. We will be using this book occasionally as a complement to Wald.

S. Weinberg, *Gravitation and Cosmology* (New York, Wiley, 1972) [Qc6.W42]. This book adopts a field-theoretic, non-geometric approach to general relativity, which is very different from the approach we will be following. However, it is a detailed and comprehensive book covering many advanced topics. It is strong on astrophysics, cosmology, and experimental tests; it will be most useful for P6554 in the spring semester.

S. Carroll, *Spacetime and Geometry: An Introduction to General Relativity*, (Pearson Addison Wesley, 2003) [QC173.6 .C377 2004]. This book gives a more introductory and less detailed treatment than the two books listed above, but has the advantages of being clear, readable and pedagogical, and also being very up-to-date. It makes connections to modern research topics in cosmology and string theory. I recommend consulting this book as a supplement to Wald if you have not had any previous exposure to general relativity.

J.B. Hartle, *Gravity: An Introduction to Einstein's General Relativity*, (Addison Wesley, San Francisco, 2003) [QC173.6 .H38 2003]. This is an introductory, undergraduate level textbook which pioneers a new approach to teaching the subject, in which the key physical predictions (Schwarzschild solution etc.) are covered before the field equations. It was written by one of the masters of the field of relativity and is probably the best introductory book on the subject.

S.W. Hawking and G.F.R. Ellis, *The Large-Scale Structure of Space-Time* (Cambridge University Press, Cambridge, 1973). An advanced book which emphasizes global techniques and singularity theorems, pitched at a high mathematical level.

A.P. Lightman, W.H. Press, R.H. Price, and S.A. Teukolsky, *Problem book in relativity and gravitation* (Princeton University Press, Princeton, 1975) [QC173.55.P96]. A very useful book containing almost 500 problems in all areas of special and general relativity, with fully worked solutions. Consult it to understand the nuts and bolts of calculational methods.

B.F. Schutz, *A First Course in General Relativity* (Cambridge University Press, Cambridge, 1985). [QC 173.6.S38x]. This is a very clear and useful introductory text.

Mathematical texts on differential geometry include

R.L. Bishop and S.I Goldberg, *Tensor analysis on manifolds*, (McMillan, New York, 1968). A thorough and detailed treatment of the basics of differential geometry; my favorite book.

B. O'Neill, *Semi-Riemannian geometry : with applications to relativity*, (Academic Press, New York, 1983). Another detailed exposition of differential geometry, together with some advanced topics. Covers more material than Bishop and Goldberg.

C. Nash and S. Sen, *Topology and Geometry for Physicists* (Academic Press, 1983). Less rigorous than the above two books. Includes rather more mathematical machinery than we will need: homotopy, homology, fiber bundles and Morse theory, with applications to physics.