EE 261 The Fourier Transform and its Applications
Some References

Our course will be based on the course reader, available at the bookstore and also on the course web site. This is really a collection of lecture notes masquerading as a book. You'll probably find phrases like 'as we saw in Lecture 6' (point those out to me, please), Appendices in the middle of chapters, etc. This shouldn't be a problem in your following the exposition, and, as I hope you'll be able to detect, the notes were written for students to read, not with the specter of imperious, mathematical colleagues looking over my shoulder as I wrote them. Comments and corrections are most welcome.

Two books that have been used often as texts for 261 are:

R. M. Gray and J. W. Goodman **Fourier Transforms**, Kluwer, 1995

R. N. Bracewell, **The Fourier Transform and its Applications**, McGraw Hill, 1986

> These are the primary additional references for the course. The feature of Gray & Goodman that makes it different from most other books is the parallel treatment of the continuous and discrete cases throughout. Though we won't follow that approach per se, it makes good parallel reading to what we'll do. Bracewell, now in its third edition, is also highly recommended. Both books are on reserve in Terman library along with several others listed below.

Some other references (among *many*), and in no particular order, are:

J. F. James, **A Student's Guide to Fourier Transforms** 2^{nd} ed., Cambridge, 2002

> This is a good, short book (130 pages), similar to Bracewell to some extent, with about 70% devoted to various applications. The topics and examples are interesting and relevant. There are, however, some pretty obscure mathematical arguments, I think, and some errors, too.

Jack D. Gaskill, **Linear Systems, Fourier Transforms, and Optics**, Wiley, 1978

> This is sometimes used as a text for EE261. The applications are drawn primarily from optics (nothing wrong with that) but the topics and treatment mesh very well with the course overall. Clearly written.

David W. Kammler, **A First Course in Fourier Analysis**, Prentice hall, 2000

> This is a relatively recent book that has been used in the winter version of EE261. It's more on the mathematical side of things, very well written, and with many worked examples and a good selection of problems.

S. Papoulis, **The Fourier Transform and its Applications**, McGraw Hill, 1960

> Same title as Bracewell's book, but a more formal mathematical treatment. Papoulis has written a whole slew of EE books. Two others that are relevant to the topics in this class are:

S. Papoulis, **Systems and Transforms With Applications in Optics**, Krieger Publishing Company, 1981

S. Papoulis, **Probability, Random Variables, and Stochastic Processes**, McGraw Hill, 1991

> This last one has very general forms of the sampling theorem, including reconstruction by random sampling. Read this and be one of the few people on earth to know these results.

P. J. Nahim, **The Science of Radio**, 2nd edition, Springer, 2001

> This is an interesting and entertaining book on the history and practice of radio. Of relevance to our course are treatments of the Fourier analysis of radio signals, from sparks to AM. The author's intention is to start from scratch and take a 'top down' approach.

Some references for the discrete Fourier transform and the fast Fourier transform algorithm are:

E. O. Brigham, **The Fast Fourier Transform**, Prentice Hall, 1974

> This is a standard reference and I included it because of that. I think it's kind of clunky, however.

W. Briggs & V. Henson, **The DFT: An Owner's Manual for the Discrete Fourier Transform**, SIAM, 1995

> I really like the treatment in this book; the topics, the examples, the problems are all well chosen.

A highly respected, advanced book on the FFT algorithm is

C van Loam, **Computational Frameworks for the Fast Fourier Transform**, SIAM 1992

Books more often found on mathematician's shelves include:

H. Dym and H. P. McKean, **Fourier Series and Integrals**, Academic Press, 1972

> This is a very well written, straightforward mathematical treatment of Fourier series and Fourier transforms. It includes a brief development of the theory of integration needed for the mathematical details (the L^2 and L^1 theory). It also includes chapters on the applications of complex analysis to Fourier analysis and on Fourier analysis on groups. Breezy style, but sophisticated.

T. W. Körner, **Fourier Analysis**, Cambridge, 1988

This is a wonderful book full of the lore of Fourier analysis for mathematicians (and others). Broken up into 110 (!) small chapters, it's written with a light touch and with lots of illuminating comments. Körner has also written a separate book of exercises on Fourier analysis (Cambridge Press, 1993) as an accompaniment. He spoke for all of us in trying to find good exercises when he quoted a verse from Kipling in the Preface. You can look it up.

R. Strichartz, **A Guide to Distribution Theory and Fourier Transforms**, CRC Press, 1994

This is an accessible introduction to distributions (generalized functions) and their applications, at the advanced undergraduate, beginning graduate level of mathematics. It's a good way to see how distributions and Fourier transforms have become fundamental in studying partial differential equations (at least for proving theorems, if not for computing solutions).

A. Terras, **Harmonic Analysis on Symmetric Spaces and Applications, I, II**, Springer Verlag, 1988

If you want to see how the Fourier transform is generalized to the setting of Lie groups, and why it's such a big deal in number theory, these books are an excellent source. Let me know if you believe the applications.

I will be finding inspiration (read: stealing) from all of these sources, and there are many others. I encourage you to browse the library.