Exterior Course Website: http://www.stevenheilman.org/~heilman/545s20.html
Prerequisite: MATH 225, MATH 226, and MATH 208. (It is helpful, though not necessary, to have taken graduate versions of these classes such as 507A, 525A, 541A.).
Course Content: Transfer function models; stationary, nonstationary processes; moving average, autoregressive models; spectral analysis; estimation of mean, autocorrelation, spectrum; seasonal time series.

Lecture Meeting Time/Location: Mondays, Wednesdays, and Fridays, 9AM-9:50AM, KAP 140
Instructor: Steven Heilman, stevenmheilman@gmail.com
Office Hours: Mondays, 10AM-12PM, or by appointment, KAP 406G
Recommended Textbook (not required): Brockwell and Davis, Time Series, Theory and Methods, 2nd edition. The plan is to cover chapters 1-3, 5, and 7-9 of this book.
Other Textbooks: Brockwell and Davis, Introduction to Time Series and Forecasting. A more elementary version of the other book by the same authors. Copertwait and Metcalfe Introductory Time Series with R. A text focusing on time series in the R programming language.
First Midterm: Friday, February 14, 9AM-9:50AM, KAP 140
Second Midterm: Friday, March 27, 9AM-9:50AM, KAP 140
Final Exam: Friday, May 8, 8AM-10AM, Location TBD

Email Policy:

- My email address for this course is stevenmheilman@gmail.com.
- It is your responsibility to make sure you are receiving emails from stevenmheilman@gmail.com, and they are not being sent to your spam folder.
- Do NOT email me with questions that can be answered from this document.

Exam Procedures: Students must bring their USCID cards to the midterms and to the final exam. Phones must be turned off. Cheating on an exam results in a score of zero on that exam. Exams can be regraded at most 15 days after the date of the exam. This policy extends to homeworks as well. All students are expected to be familiar with the USC Student Conduct Code. (See also here.)

Student Conduct: Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity http://equity.usc.edu or to the Department of Public Safety http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety whole USC community. Another member of the university community - such as a friend, classmate, advisor, or faculty member - can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage sarc@usc.edu describes reporting options and other resources.
Disability Services: If you are registered with disability services, I would be happy to discuss this at the beginning of the course. Any student requesting accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. DSP is located in 301 STU and is open 8:30am-5:00pm, Monday through Friday.

https://dsp.usc.edu
213-740-0776 (phone)
213-740-6948 (TDD only)
213-740-8216 (fax)
ability@usc.edu

Exam Resources: Here is a page containing old exams for a course similar to ours. The material on these exams might differ from the material on our exams.

Homework Policy:

- Late homework is not accepted.
- If you still want to turn in late homework, then the number of minutes late, divided by ten, will be deducted from the score. (The time estimate is not guaranteed to be accurate.)
- The lowest homework score will be dropped. This policy is meant to account for illnesses, emergencies, etc.
- Do not submit homework via email.
- There will be 6 homework assignments, turned in at the beginning of class on certain Fridays.
- A random subset of the homework problems will be graded each week. However, it is strongly recommended that you try to complete the entire homework assignment.
- You may use whatever resources you want to do the homework, including computers, textbooks, friends, the TA, etc. However, I would discourage any over-reliance on search technology such as Google, since its overuse could degrade your learning experience. By the end of the semester, you should be able to do the entire homework on your own, without any external help.
- All homework assignments must be written by you, i.e. you cannot copy someone else’s solution verbatim. However, I would very much encourage you to form study groups and do the homework together in small groups. Homework is the most important part of a graduate mathematics course, and I encourage you to take it very seriously.

Grading Policy:

- The final course grade is weighted as the larger of the following two schemes. Scheme 1: homework (20%), the first midterm (20%), the second midterm (25%), and the final (35%). Scheme 2: homework (20%), the largest midterm grade (30%), and the final (50%).
The grade for the semester will be curved. However, I do not “curve down” since anyone who exceeds my expectations in the class by showing A-level performance on the exams and homeworks will receive an A for the class.

If you cannot attend one of the exams, you must notify me within the first two weeks of the start of the quarter. Later requests for rescheduling will most likely be denied.

You must attend the final exam to pass the course.

**Tentative Schedule:** (This schedule may change slightly during the course.)

<table>
<thead>
<tr>
<th>Week</th>
<th>Monday</th>
<th>Tu</th>
<th>Wednesday</th>
<th>Th</th>
<th>Friday</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>Jan 20: No class</td>
<td>Jan 21</td>
<td>Jan 22: 1.2, Stochastic Processes</td>
<td>Sep 5</td>
<td>Jan 24: Homework 1 due, 1.3, Stationarity</td>
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<td>3</td>
<td>Jan 27: 1.4, Estimation</td>
<td>Jan 28</td>
<td>Jan 29: 1.5, Autocovariance</td>
<td>Jan 30</td>
<td>Jan 31: 1.6, Multivariate Normal</td>
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<td>4</td>
<td>Feb 3: 2.1, 2.2, Hilbert Spaces</td>
<td>Feb 4</td>
<td>Feb 5: 2.3, 2.4, 2.5, Hilbert Space Projections</td>
<td>Feb 6</td>
<td>Feb 7: Homework 2 due, 2.6, Linear Regression</td>
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<td>5</td>
<td>Feb 10: 2.7, Hilbert Spaces and Linear Regression</td>
<td>Feb 11</td>
<td>Feb 12: 2.8, Fourier Series</td>
<td>Feb 13</td>
<td>Feb 14: Exam 1</td>
</tr>
<tr>
<td>6</td>
<td>Feb 17: No class</td>
<td>Feb 18</td>
<td>Feb 19: 2.8, Fourier Series</td>
<td>Feb 20</td>
<td>Feb 21: 2.8, Random Fourier Series</td>
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<tr>
<td>7</td>
<td>Feb 24: 3.1, ARMA Processes</td>
<td>Feb 25</td>
<td>Feb 26: 3.1, ARMA Processes</td>
<td>Feb 27</td>
<td>Feb 28: Homework 3 due, 3.2, ARMA of Infinite Order</td>
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<td>8</td>
<td>Mar 2: 3.4, Partial Autocorrelation</td>
<td>Mar 3</td>
<td>Mar 4: 3.5, Autocovariance Generating Function</td>
<td>Mar 5</td>
<td>Mar 6: 4.1, 4.2, Spectral Representation</td>
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<tr>
<td>10</td>
<td>Mar 16: No class</td>
<td>Mar 17</td>
<td>Mar 18: No class (spring break)</td>
<td>Mar 19</td>
<td>Mar 20: No class (spring break)</td>
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<td>12</td>
<td>Mar 30: 5.4, Gaussian Prediction</td>
<td>Mar 31</td>
<td>Apr 1: 5.5, ARMA Prediction</td>
<td>Apr 2</td>
<td>Apr 3: 5.6, Frequency Prediction</td>
</tr>
<tr>
<td>13</td>
<td>Apr 6: 7.1, Mean Estimation</td>
<td>Apr 7</td>
<td>Apr 8: 7.2 Estimation</td>
<td>Apr 9</td>
<td>Apr 10: Homework 5 due, 7.2, Estimation</td>
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<tr>
<td>14</td>
<td>Apr 13: 10.1, 10.2, Spectral Inference</td>
<td>Apr 14</td>
<td>Apr 15: 10.1, 10.2, Spectral Inference</td>
<td>Apr 16</td>
<td>Apr 17: 10.6, Maximum Likelihood ARMA Spectral Estimation</td>
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<tr>
<td>15</td>
<td>Apr 27: Leeway</td>
<td>Apr 28</td>
<td>Apr 29: Leeway</td>
<td>Apr 30</td>
<td>May 1: Homework 6 due. Review of course</td>
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</tbody>
</table>


Advice on succeeding in a math class:

- Review the relevant course material **before** you come to lecture. Consider reviewing course material a week or two before the semester starts.

- When reading mathematics, use a pencil and paper to sketch the calculations that are performed by the author.

- Come to class with questions, so you can get more out of the lecture. Also, finish your homework at least **two days** before it is due, to alleviate deadline stress.

- Write a rough draft and a separate final draft for your homework. This procedure will help you catch mistakes. Also, I would very much recommend **typesetting** your homework. Learning LaTeX is a very important skill to have for doing mathematics. [Here](#) is a template .tex file if you want to get started typesetting.

- If you are having difficulty with the material or a particular homework problem, review Polya’s **Problem Solving Strategies**, and come to office hours.