

Prefix, Number and Name of Course: PSM 662 Time Series Analysis and Forecasting

Credit Hours: 1

In Class Instructional Hours: 1

Labs: 0

Studio: 0

Field Work: 0

Catalogue Description:

Prerequisite: PSM 640 or instructor permission

Time and frequency domain techniques including autocorrelation, spectral analysis, autoregressive moving average and integrated moving average models, Box-Jenkins methodology, fitting, forecasting and seasonal adjustments.

Reasons for addition:

To create a one-semester-hour module for the graduate Professional Applied and Computational Mathematics program where students will formulate and solve real life problems using time series analysis: a statistical tool for the analysis of data which are collections of observations made sequentially in time, where observations are dependent and where the nature of this dependence is of interest in itself.

Student Learning Outcomes: Students will	Course Content References:	Assessments:
1. plot time-series data and describe trends, seasonal fluctuations, other cyclical changes and irregular fluctuations.	I.A-B	Individual homework assignments, group work, examinations and computer projects.
2. construct and analyze a variety of suitable probability models to observed time series in the time domain using the autocorrelation function, to describe the evolution of a process through time.	I.C-I.I	Individual homework assignments, group work, examinations and computer projects.
3. select and apply an appropriate forecasting procedure for future values of an observed time series for a given set of conditions.	II	Individual homework assignments, group work, examinations and computer projects.
4. analyze spectral analysis of time series in the frequency domain using the spectral density function to describe variation in time series accounted for by cyclical components at different frequencies.	III-IV	Individual homework assignments, group work, examinations and computer projects.

5. use appropriate statistical software to analyze real world problems.	I-IV	Individual homework assignments, group work, and computer projects.
<p>Course Content:</p> <p>I. Fitting time-series models in the time domain</p> <ul style="list-style-type: none"> A. Introduction to the nature, terminology, and objectives of time-series analysis B. Descriptive techniques C. Estimating the autocovariance and autocorrelation functions D. Fitting an autoregressive process E. Fitting a moving average process F. Mixed model G. Integrated model H. Box-Jenkins model I. Residual analysis <p>II. Forecasting</p> <ul style="list-style-type: none"> A. Univariate procedures B. Multivariate procedures C. Comparative review of forecasting procedures <p>III. Stationary processes in the frequency domain</p> <ul style="list-style-type: none"> A. The spectral distribution function B. The spectral density function C. The spectrum of a continuous process <p>IV. Spectral analysis</p> <ul style="list-style-type: none"> A. Fourier analysis B. Simple sinusoidal models C. Periodogram analysis D. Estimation procedures and comparisons E. Analyzing a continuous time series 		

Resources

Scholarship:

Box, G. E. P., Jenkins, G. M., and Reinsel, G. C., *Time Series Analysis: Forecasting and Control*, 4th ed., Prentice Hall, 2008.

Brockwell, P. J., and Davis, R. A., *Time Series: Theory and Methods*, 2nd ed., Springer-Verlag, 1991.

Brockwell, P. J., and Davis, R. A., *Introduction to Time Series and Forecasting*, 2nd ed., Springer, 2003.

- Chatfield, C., *The Analysis of Time Series: An Introduction*, 6th ed., Chapman & Hall/CRC, 2004.
- Cryer, J. D., *Time Series Analysis*, Duxbury Press, 1986.
- Diggle, P. J., *Time Series: A Biostatistical Introduction*, Oxford University Press, 1990.
- Montgomery, D. C., Jennings, C. L., and Kulahci, M., *Introduction to Time Series Analysis and Forecasting*, Wiley, 2008.
- Ostrom, C. W., *Time Series Analysis: Regression Techniques*, 2nd ed., CA: Sage, 1990.
- Pena, D., Tiao, G. C., and Tsay, R. S., *A Course in Time Series Analysis*, Wiley, 2001.
- Quarrie, M. C., Allan, D. R., and Tsai, C. L., *Regression and Time Series Model Selection*, World Scientific, 1998.
- Reinsel, G. C., *Elements of Multivariate Time Series*, 2nd ed., Springer, 1997.
- Shumway, R. H., and Stoffer, D. S., *Time Series Analysis and Its Applications*, 2nd ed., Springer 2006.
- Yaffee, R. A., and McGee, M., *Introduction to Time Series Analysis and Forecasting with Applications of SAS and SPSS*, Wiley, 2000.
- Zellner, A., *Statistics, Econometrics, and Forecasting*, Cambridge University Press, 2004.

Periodicals:

- Annals of Applied Statistics*
- Annals of Mathematical Statistics*
- Annals of Statistics*
- Biometrics*
- Biometrika*
- Communications in Statistics*
- Econometrica*
- International Statistical Review*
- Journal of the American Statistical Association*
- Journal of Applied Statistics*
- Journal of Applied Statistical Science*
- Journal of Statistical Computation and Simulation*
- Journal of the Royal Statistical Society*

Scandinavian Journal of Statistics

Statistics in Medicine

Statistical Methods in Medical Research

Technometrics

The American Statistician

Electronic and/or Audiovisual Resources:

DTREG, "Time Series Analysis," www.dtreg.com/TimeSeries.htm.

SAS, "Econometrics and Time Series with SAS/ETS Software,"
www.sas.com/technologies/analytics/forecasting/ets/index.html.

SPSS, "Time Series Analysis and Forecasting," www.spss-sa.com/spss_trends.html.

StatGraphics, "Time Series Analysis and Forecasting,"
www.statgraphics.com/time_series_analysis.htm.