DE LA SALLE UNIVERSITY – MANILA
COLLEGE OF SCIENCE
Mathematics Department

SYLLABUS

COURSE CODE	MSS605M
COURSE TITLE	Time Series Analysis
CLASS DAY & TIME	
ROOM	
NAME OF FACULTY	
COURSE CREDIT	3 units
CONTACT NO. (DEPT)	(02) 536-0270, (02) 524-4611 loc. 420/413
TERM/SCHOOL YEAR	

COURSE DESCRIPTION

A course on linear extrapolation, exponential smoothing, ARMA and ARIMA processes, unit root testing, transfer functions and applications, and GARCH models.

PREREQUISITE

Introduction to the Theory of Linear Models

COURSE OBJECTIVES

- differentiate between two approaches to forecasting using time series data;
- apply regression analysis to forecasting;
- apply stochastic time series models to forecasting;
- appreciate the value of statistics as a tool in improving the quality of life;
- develop honesty and objectivity in recording, analyzing and interpreting data;
- exhibit values like:

º cooperation through group study;
º self-reliance by being able to solve problems independently;
º honesty by claiming credit only for the work he has done;
º zeal and seriousness of intent to learn by participating actively in class discussion, doing his homework regularly and consulting with his mentor;
º patience, perseverance and diligence by solving assigned exercise completely including the difficult ones;
º faith by doing what is right and giving one's best in performing assigned task;
º rapport and harmony with others in the pursuit of solutions to problems;
º neatness, orderliness and accuracy in presenting solutions to problems;
º industry and self-discipline by doing assignment and seatwork exercises;
º show concern for the community through sharing of know-how and resources during group discussion.

Topic/Subtopic	Learning Strategies/ Activities	Week/Meeting/ Hour
1. INTRODUCTION	Lecture	

Topic/Subtopic	Learning Strategies/ Activities	Week/Meeting/ Hour
1.1 Definition of Terms 1.2 Components of a Time Series 1.3 Overview of Forecasting Methods	Class Discussion Problem Set Computer Lab Exercises	1.5 Hours
2. FUNDAMENTAL CONCEPTS 2.1 Stochastic Processes 2.2 The Autocovariance and Autocorrelation Functions 2.3 The Partial Autocorrelation Function 2.4 White Noise Processes 2.5 Estimation of the Mean, Autocovariances, and Autocorrelations 2.6 Sample Mean 2.7 Sample Autocovariance Function 2.8 Sample Autocorrelation Function 2.9 Sample Partial Autocorrelation Function 2.10 Moving Average and Autoregressive Representations of Time Series Processes 2.11 Linear Difference Equations	Lecture Class Discussion Problem Set Computer Lab Exercises	4.5 Hours
3. STATIONARY TIME SERIES MODELS 3.1 Autoregressive Processes 3.2 The First-Order Autoregressive AR(1) Process 3.3 The Second-Order Autoregressive AR(2) Process 3.4 The General *p*th-Order Autoregressive AR(*p*) Process 3.5 Moving Average Processes 3.6 The First-Order Moving Average MA(1) Process 3.7 The Second-Order Moving Average MA(2) Process 3.8 The General *q*th-Order Moving Average MA(*q*) Process 3.9 The Dual Relationship Between AR(*p*) and MA(*q*) Processes 3.10 Autoregressive Moving Average ARMA (*p, q*) Processes 3.11 The General Mixed ARMA(*p, q*) Process 3.12 The ARMA(1, 1) Process	Lecture Class Discussion Problem Set Computer Lab Exercises	3 Hours
4. NONSTATIONARY TIME SERIES MODELS 4.1 Nonstationarity in the Mean 4.2 Deterministic Trend Models 4.3 Stochastic Trend Models and Differencing 4.4 Autoregressive Integrated Moving Average (ARIMA) Models 4.5 The General ARIMA Model 4.6 The Random Walk Model 4.7 The ARIMA(0, 1, 1) or IMA(1, 1) Model 4.8 Nonstationarity in the Variance and the Autocovariance 4.9 Variance and Autocovariance of the ARIMA Models 4.10 Variance Stabilizing Transformations	Lecture Class Discussion Problem Set Computer Lab Exercises	3 Hours
5. FORECASTING	Lecture	3 Hours

Topic/Subtopic	Learning Strategies/ Activities	Week/Meeting/ Hour
5.1 Introduction 5.2 Minimum Mean Square Error Forecasts 5.3 Minimum Mean Square Error Forecasts for ARMA Models 5.4 Minimum Mean Square Error Forecasts for ARIMA Models 5.5 Computation of Forecasts 5.6 The ARIMA Forecast as a Weighted Average of Previous Observations 5.7 Updating Forecasts 5.8 Eventual Forecast Functions 5.9 A Numerical Example	Class Discussion Problem Set Computer Lab Exercises	
6. MODEL IDENTIFICATION 6.1 Steps for Model Identification 6.2 Empirical Examples 6.3 The Inverse Autocorrelation Function (IACF) 6.4 Extended Sample Autocorrelation Function and Other Identification Procedures 6.5 The Extended Sample Autocorrelation Function (ESACF) 6.6 Other Identification Procedures	Lecture Class Discussion Problem Set Computer Lab Exercises	3 Hours
7. PARAMETER ESTIMATION, DIAGNOSTIC CHECKING AND MODEL SELECTION 7.1 The Method of Moments 7.2 Maximum Likelihood Method 7.3 Conditional Maximum Likelihood Estimation 7.4 Unconditional Maximum Likelihood Estimation and Backcasting Method 7.5 Exact Likelihood Functions 7.6 Nonlinear Estimation 7.7 Ordinary Least Squares (OLS) Estimation in TimeSeries Analysis 7.8 Diagnostic Checking 7.9 Empirical Examples for Series W1-W7 7.10 Model Selection Criteria	Lecture Class Discussion Problem Set Computer Lab Exercises	3 Hours
8. SEASONAL TIME SERIES MODELS 8.1 General Concepts 8.2 Regression Method and Moving Average Method 8.3 Seasonal ARIMA Models 8.4 Empirical Examples	Lecture Class Discussion Problem Set Computer Lab Exercises	3 Hours
9. TESTING FOR A UNIT ROOT 9.1 Introduction 9.2 Testing for a Unit Root in the AR(1) Model 9.3 Testing for a Unit Root in the General Model 9.4 Testing for a Unit Root in a Seasonal Time Series Model		1.5 Hours
10. INTERVENTION ANALYSIS AND OUTLIER DETECTION 10.1 Intervention Models 10.2 Time Series Outliers: Additive and Innovative Outliers 10.3 Examples of Outlier Analysis		4.5 Hours
11. TRANSFER FUNCTION MODELS		6 Hours

Topic/Subtopic	Learning Strategies/ Activities	Week/Meeting/ Hour
11.1 Single-Input Transfer Function Models 11.2 The Cross-Correlation Function (CCF) and Transfer Function Models 11.3 Construction of Transfer Function Models 11.4 Forecasting Using Transfer Function Models		
12. TIME SERIES REGRESSION AND GARCH MODELS 12.1 Regression with Autocorrelated Errors 12.2 ARCH and GARCH Models 12.3 Estimation of GARCH Models: MLE and Iterative Estimation 12.4 Computation of Forecast Error Variance 12.5 Illustrative Examples		6 Hours
Final Output		

TEACHING STRATEGIES/METHODOLOGY

1. Lecture and Recitation
2. Individual Seatwork on Problem Solving
3. Cooperative or Group Learning
4. SAS Hands-on Exercises

COURSE REQUIREMENTS

1. Examinations / Reports
2. SAS outputs with discussions
3. Learning Output – critique of a paper

SOURCES

- Asteriou, Dimitrios and Hall, Stephen G. (2011). *Applied Econometrics.* Basingstoke, Hampshire: Palgrave Macmillan.
- Bowerman, Bruce L., O'Connell, Richard T., and Koehler, Anne B. (2005). *Forecasting, Time Series, and Regression.* Belmont, CA: Thomson Books/Cole.
- *Chatfield, Chris. (2004). The Analysis of Time Series, 6th ed. Boca Raton: Chapman and Hall/ CRC.*
- *Chipman, John Somerset. (2011). Advanced Econometric Theory. London: Routledge.*
- DeLurgio, Stepthen A. (1998). *Forecasting Principles and Applications.* Irwin/McGraw-Hill.
- Enders, Walter. (2010). *Applied Econometric Time Series, 3rd ed.* NJ: Wiley
- Greene, William H. (2012). *Econometric Analysis, 7th ed.* Boston: Pearson.
- Gujarati, Damodar. (2011). *Econometrics by Example.* NY: Palgrave Macmillan.
- Hill, R. Carter, Griffiths, William E., and Lim, Guay C. (2012). *Principles of Econometrics. NJ: Wiley.*
- *Prado, Raquel and West, Mike. (2010). Time Series: Modeling, Computation, and Inference. Boca Raton: CRC*

Press.
- *Shumway, Robert H. and Stoffer, David S. (2011). Time Series Analysis and Its Applications [electronic resource]: With R Examples. New York: Springer.*
- *Studenmund, A.H. (2011). Using Econometrics: A Practical Guide, 6th ed. Boston, Mass.: Pearson.*
- *Tsay, Ruey S. (2005). Analysis of Financial Time Series. NY: Wiley-Interscience.*
- *Wei, William W.S. (2006). Time Series Analysis : Univariate and Multivariate Methods, 2nd edition. Boston: Pearson/Addison-Wesley.*
- *Wooldridge, Jeffrey M. (2010). Econometric Analysis of Cross Section and Panel Data, 2nd ed. Cambridge, Mass.: MIT Press.*

ONLINE RESOURCES

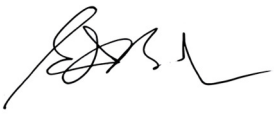
- Second Moment: Time Series Analysis Site Links from http://www.secondmoment.org/time_series.php
- Some Time Series Analysis Resources from http://antianti.org/?p=18
- Time Series Data Library from http://robjhyndman.com/TSDL/
- gretl software homepage: **http://gretl.sourceforge.net/**

FACULTY OUTPUT

- Janairo, Jose Isagani B., Co, Frumencio F., Carandang VI, Jose Santos R., and Amalin, Divina M. (2015). Sequence-dependent cluster analysis of biomineralization peptides. *Zeitchrift Fur Naturforschung C (A Journal of Biosciences)*, 70(7-8)c, pp. 191-195.ISSN 0939-5075.
- Palisoc, Shirley T., Natividad, Michelle T., Co, Frumencio F., and Kaw, Kevin Anthony Y. (2015). Morphological, thickness and electrochemical analyses of spin-coated $[Ru(NH_3)_6]^{3+}$/Nafion films. *Optoelectronics And Advanced Materials – Rapid Communications*, Vol. 9, No. 7-8, July – August 2015, p. 1010 – 1013.
- Abolencia, Jesper L., Quipit Jr., Ananias G., Leong, Robert Neil F., and Co, Frumencio F. (2015). Ordinal Regression Analyses of Breastfeeding Duration in the Philippines. *International Journal of Philippine Science and Technology, 8(1), 22-26.*
- *Angkiko, Lorraine Christelle B., Diaz, Priscilla A., Robert Neil F., and Co, Frumencio F. (2014). Biosurveillance of Measles using Control Charts: A Case Study using National Capital Region Laboratory Confirmed Measles Counts from January 2009 to January 2014. The Philippine Statistician, 63(2), 31-49.*
- *Chan, Lailani D., Putong, Ilene Renee L., and Co, Frumencio F. (2014). Analysis of an SEIRS Compartmental Model for Tuberculosis in Quezon City from 2007 to 2011. The DLSU Mathematics Inbox, 1(2),67-79.*
- *Beltrano, Elline Jade, Leong, Robert Neil F., and Co, Frumencio F. (2013). Regression Analyses of the Philippine Birth Weight Distribution. The Philippine Statistician, 62(2), 31-52.*
- Arcilla, R., Co, F., Ocampo, S., and Tresvalles, R. (2013). *Statistical Literacy for Lifelong Learning*. Abiva Publishing
- Ocampo, S., Arcilla, R., Co, F., Jumangit, R., and Diokno, F. (2013). Enthusing students towards statistical literacy using transformative learning paradigm: Implementation and Appraisal. *2013 IASE/IAOS Conference Proceedings*, IASE/IAOS, Hong Kong/Macau, China, August 2013.
- Carandang, J. and Co, F. (2012). Some factors affecting the student evaluation ratings of Biology faculty at DLSU. *3rd International DLSU Education Congress Proceedings*, DLSU College of Education, Manila, September, 2012, ISSN 2244-0151.
- Co, F., Arcilla, R., and Ocampo, S. (2012). Correlates of Hunger: Evidence from the CBMS Data of Pasay City. *Proceedings of the 2012 PSA Annual Conference*, Philippine Statistical Association, Quezon City, August 2012
- Ocampo, S., Arcilla, R., Co, F., Jumangit, R. and Diokno, F. J. (2011).Exploring Latent Factors Using Non-Bayesian and Bayesian Factor Analyses. *DLSU Science and Technology Congress Proceedings*, DLSU, Manila, February 2011.

- Janairo, Jose Isagani B., Janairo, Gerardo C., Co, Frumencio F., and Yu, Derrick Ethelbert C. (2011). Assessing the Binding Affinity of a Selected Class of DPP4 Inhibitors using Chemical Descriptor-Based Multiple Linear Regression. *Orbital* (The Electronic Journal of Chemistry), Vol. 3, No. 1, January – March 2011, pp. 15-23 (ISSN 1984-6428 , http://www.orbital.ufms.br/inpress/inpress.htm).
- Janairo, Jose Isagani B., Co, Frumencio F., Janairo, Gerardo C., and Yu, Derrick Ethelbert C. (2010). Regression Analysis on the Chemical Descriptors of a Selected Class of DPP4 Inhibitors. *Studies in Mathematical Sciences*, Vol. 1, No. 1, 2010, pp. 01-06 (ISSN 1923-8444-Print; ISSN 1923-8452 – Online, www.cscanada.net).
- Arcilla, R., Co, F., and Ocampo, S. (2011). Correlates of Poverty: Evidence from the Community-Based Monitoring System (CBMS) Data. *DLSU Business and Economics Review*, Vol. 20, No. 2, January 2011, pp. 33-43 (ISSN 0116-7111, http://www.philjol.info/philjol/index.php/BER/article/view/1912).
- Acelajado, M., Beronque, Y., and Co, F. (2007). *Algebra: Concepts and Processes, 3rd edition.* National Book Store. ISBN 971-08-6580-3.

Noted by:



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