Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: ECO 5XX (DE for second or third- or fourth-year BS student and or MSc First year students)
2. Course Title: Applied Time Series Econometrics with Application in Trade and Macroeconomics
3. Per Week Lectures:3(L)+ 0(T)+0(P) +0(A):9
4. Duration of Course: Full Semester (Total of 40 Lectures)
5. Proposing Department: Economic Sciences

   Other Departments/IDPs which may be interested in the proposed

   course: Other faculty members interested in teaching the proposed course

6. Proposing Instructor(s): Prof. Somesh Kumar Mathur
7. Course Description:
    a. Objectives: The objective of introducing an Applied Time Series Course with Applications in Macroeconomics and Trade is to equip students and researchers with the theoretical foundation, empirical tools, and practical applications required to analyze time-dependent data in the context of macroeconomic and international trade phenomena.
    b. Contents:

S.No	Broad Title	Topics	No. of Lectures
1	Introduction to Time Series Analysis	- Importance in macro econometrics and Trade - Types of time series: stationary vs. non-stationary. - Key concepts: trends, seasonality, cycles.	4
2	Stationarity and Unit Root Tests	- Definition and importance of stationarity. - Testing for unit roots: ADF, PP, KPSS tests. - Implications of non-stationarity for econometric analysis.	4
3	Modeling Trends	- Deterministic vs. stochastic trends.	4

		- Hodrick-Prescott filter, Beveridge-Nelson decomposition.	
4	ARMA and ARIMA Models	- Autoregressive (AR) and Moving Average (MA) models. - ARIMA: Differencing to achieve stationarity. - Model selection using AIC, BIC.	4
5	Cointegration and Error Correction Models	- Long-run equilibrium relationships. - Engle-Granger two-step method. - Johansen cointegration test.	4
6	Vector Autoregressions (VAR)	- Structural vs. reduced-form VARs. - Impulse response functions (IRFs). - Variance decomposition.	4
7	Structural Breaks and Regime Switching	- Testing for structural breaks: Chow test, Bai-Perron method. - Markov switching models.	4
8	Volatility Models	- ARCH and GARCH models. - Extensions: EGARCH, TGARCH, and multivariate GARCH.	4
9	Forecasting in Time Series	- Evaluation metrics: RMSE, MAE, MAPE. - Forecast combination methods.	4
10	Applications in Macroeconomics and Trade through R, Stata and Python codes	- Estimating potential GDP and output gaps. - Business cycle analysis. - Fiscal and monetary policy effects. - Structural gravity model with high dimension data -PPML-HDFE	4
Total Lectures			40

c. Pre-requisites: None
d. Short summary for including in the Courses of Study Booklet: To build foundational knowledge in time series analysis with special focus on concept such as stationarity, seasonality, unit roots, structural break and volatility. Further enable practical applications in Macroeconomics and International trade. At the end, foster expertise in trade analysis by equipping students with hands-on training in R, STATA and Python.
8. Recommended books:

    a. Enders, W. (2014). Applied Econometric Time Series. Wiley.
    b. Hamilton, J. D. (1994). Time Series Analysis. Princeton University Press

    c. Lutkepohl, H. (2005). New Introduction to Multiple Time Series Analysis. Springer.

    d. B Pesaran and M. Hashem Pesaran. Time Series Econometrics
    e. Chris Brooks: Introductory Econometrics for Finance

9. Recommended Articles:

    a. Granger, C. W. J., & Newbold, P. (1974). 'Spurious Regressions in Econometrics.' Journal of Econometrics.
    b. Dickey, D. A., & Fuller, W. A. (1979). 'Distribution of the Estimators for Autoregressive Time Series with a Unit Root.' Journal of the American Statistical Association.
    c. Hodrick, R. J., & Prescott, E. C. (1997). 'Postwar U.S. Business Cycles: An Empirical Investigation.' Journal of Money, Credit, and Banking.
    d. Akaike, H. (1974). 'A New Look at the Statistical Model Identification.' IEEE Transactions on Automatic Control.
    e. Engle, R. F., & Granger, C. W. J. (1987). 'Co-Integration and Error Correction: Representation, Estimation, and Testing.' Econometrica.
    f. Sims, C. A. (1980). 'Macroeconomics and Reality.' Econometrica.
    g. Bai, J., & Perron, P. (1998). 'Estimating and Testing Linear Models with Multiple Structural Changes.' Econometrica.
    h. Bollerslev, T. (1986). 'Generalized Autoregressive Conditional Heteroskedasticity.' Journal of Econometrics.
    i. Stock, J. H., & Watson, M. W. (2002). 'Forecasting Using Principal Components from a Large Number of Predictors.' Journal of the American Statistical Association.
    j. Bernanke, B. S., & Mihov, I. (1998). 'Measuring Monetary Policy.' Quarterly Journal of Economics.

Dated: Jan 2025 Proposer: Prof. Somesh Kumar Mathur

Dated: _____ DUGC/DPGC Convener:_____

The course is approved / not approved

Chairman, SUGC/SPGC

Dated: _____