Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2022-2023

Course Handout Part II

Date: 29-08-2022

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : ECON F213
Course Title : Mathematical and Statistical Methods
Instructor-in-Charge : Rishi Kumar

Scope and Objective of the Course: This course covers the basics of mathematical fundamentals, statistical methods, and techniques necessary for economics and finance. The course is designed to give emphasis on the economic applications of various mathematical and statistical concepts.

Textbooks:

1. **T1.** Morris Degroot & Mark Schervish, "Probability and Statistics" 4th Edition, 2016
2. **T2.** Carl P Simon & Lawrence Blume, “Mathematics for economists” Viva-Norton Student edition, 2017

Reference books:

1. **R1.** David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Jeffrey D. Camm, James J. Cochran, “Statistics for Business and Economics”, Cengage Learning, Thirteenth Edition, 2015.
2. **R2.** Edward T. Dowling, “Introduction to Mathematical Economics”, Schaum’s Outline Series, Third Edition.
3. **R3.** Lind A Douglas, Marchal G William & Wathen A Samuel, "Statistical Techniques in Business and Economics", McGraw-Hill Education, Eighteen Edition, 2021.
4. **R4.** Alpha Chiang and Kelvin Wainwright, “Fundamental methods of Mathematical Economics”, TMH, 4th Ed., 2005

Course Plan:

Topic	Lecture No.	Learning objectives	Topics to be covered	Chapter in the Textbook
1	1-3	Exposure to Basics of Statistics	Data and Statistics, Scales of Measurement, Descriptive Statistics, Statistical Inference, Chebyshev’s Theorem & the Empirical Rule	Class Notes
2	4-7	Sampling Methods and the Central Limit Theorem	Sampling Methods, Sampling Distributions & the Central Limit Theorem	T1: Chapter 3 & R1: Chapter 7
3	8-20	Estimation and Hypothesis Testing	Point Estimation, Interval Estimation & Hypothesis Testing and Decision Making	T1: Chapters 6-9 & Class

				notes
4	21-25	Analysis of Variance and Chi-Squared Tests	Inferences about Population Variances, Comparing Multiple Proportions, Test of Independence and Goodness of Fit, Analysis of Variance	R1: Chapters 11-13 & Class notes
5	26-28	Correlation and Regression Analysis	Covariance, Correlation Coefficient & Simple Linear Regression Model	Class notes
6	29-30	Nonparametric Methods.	Sign Test, Wilcoxon Signed-Rank Test, Mann-Whitney-Wilcoxon Test, Kruskal-Wallis Test, Rank Correlation	R1: Chapter 18 & Class notes
7	31-32	Index Numbers	Aggregate Price Indexes, Laspeyres and Paasche Indices & Some Important Price Indexes	R1: Chapter 20
8	33-34	Functions	Increasing and Decreasing Functions, Concavity and Convexity, Relative Extrema & Inflection Points.	T2: Chapter 21 & Class notes
9	35-38	Linear Algebra	Matrices, Determinants and Non-singularity, The Jacobian, The Hessian, Higher-Order Hessians, The Bordered Hessian for Constrained Optimization, Eigenvalues and Eigenvectors & Positive Definite and Semidefinite Matrices.	T2: Chapters 8-9 & Class notes
10	39-40	Static Optimization	Optimization with & without constraints. Constrained Optimization of Multivariable Functions.	T2: Chapters 17-18 & Class notes

Learning Outcome:

Topic 1: Exposure to Basics of Statistics

In this introductory topic students will be introduced to the world of statistics. The motivation for learning statistics and wide practical application across various fields will be discussed. Some basic statistical concepts will also be revised. The main objective will be to stir the interest among pupils for the subject.

Topic 2: Sampling Methods and the Central limit theorem

This topic will focus on understanding the commonly employed sampling methods. One of the most important statistical concepts known as the central limit theorem will be introduced to the students. Sampling distribution of sample mean, and sample proportion will also be discussed.

Topic 3: Estimation and Hypothesis Testing

The students will be introduced to the techniques of estimation and hypothesis testing using the sample data. This will equip students to employ widely used statistical techniques to real world data.

Topic 4: Analysis of Variance and Chi-Squared Tests

In this topic, we will learn about Analysis of Variance (ANOVA) and Chi-squared tests. Concepts like test of Independence and Goodness of Fit test will also be discussed.

Topic 5: Correlation and Regression analysis

The linear regression is an important statistical technique with wide application. The students will be made familiar with the theoretical underpinnings of the technique so that they will be able to practically apply this technique.

Topic 6: Nonparametric Methods
In this topic, the students will be introduced to non-parametric methods which are used to make inferences about a population without requiring an assumption about the specific form of the population's probability distribution.

Topic 7: Index Numbers
Right from CPI, GVA, GDP, BSE sensex to rainfall index, the indices are everywhere. Hence, it becomes important to understand index numbers at basic level. The students will be taught regarding the various commonly used indices so that they can understand and create their own indices.

Topic 8: Functions
This topic will introduce students to concepts such as Increasing and Decreasing Functions, Concavity & Convexity. This will familiarize students with these basic concepts which they can apply in microeconomics and macroeconomics

Topic 8: Linear Algebra
In this topic, the students will revise basic concepts of linear algebra. They will specifically grasp the application of linear algebra in econometrics, microeconomics, and macroeconomics.

Topic 9: Static Optimization
The entire economics depends on optimization. The optimization could be with or without constraints. The students will increase their learning of economics as well as finance if they know optimization techniques well. The solving techniques of optimization problems will be asset for the students because optimization is extensively used in real life problems.

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid Semester Test	90 minutes	30	31/10 9.00 - 10.30AM	CB
Assignment-I	-	15	To be announced	OB
Assignment-II	-	15	To be announced	OB
Comprehensive Examination	3 hours	40	17/12 FN	CB

Chamber Consultation Hour: To be announced in the class.

Notices: All notices pertaining to this course shall be displayed on the **Economics and Finance (or) CMS Notice Board.**

Make-up Policy: Make-up will be granted only on genuine grounds and if prior permission is taken. Make-up application via sms/ messages is not acceptable; only communication through official email will be entertained.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE
ECON F213