BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE-PILANI, HYDERABAD
FIRST SEMESTER: 2023-24

Course Handout (Part II)

Date: 11/08/2023

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

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

1. Scope and Objective:

This course covers the basics of mathematical fundamentals, statistical methods and techniques to provide foundation for economics and finance in particular and, social science in general. The course is designed to give emphasis on the economic applications of various mathematical and statistical concepts. Broad topics includes basic analysis and functions, basic linear algebra, constrained and unconstrained optimization, elements of probability theory, sampling theory, statistical estimation, and hypothesis testing.

2. Text Book:

T1. Morris Degroot & Mark Schervish, "Probability and Statistics" 4th Edition, 2016

T2. Carl P Simon & Lawrence Blume, “Mathematics for economists” Viva-Norton Student edition, 2019

3. Reference Books:

R1. Michael Hoy, John Livernois, Chris McKenna, Ray Rees and Thanasis Stengos “Mathematics for Economics”, Third Edition, 2012

R2. Yamane Taro, Mathematics for Economists, Eastern Economy Edition, 2nd Edition 1985

R3. Alpha Chiang and Kelvin Wainwright, “Fundamental methods of Mathematical Economics”, TMH, 4th Ed., 2005

R4. Bruce Hansen, “Probability and Statistics for Economists”, Princeton University Press, 2022

4. Course Plan:

Topic	Lec. no.	Learning Objective	Topics to be covered	Chapter in the Text Book
Module 1: Analysis & Functions				
1	1-7	Analysis & Functions-	Analysis- Open, Closed and Compact Sets, Convex Sets, Connected Sets- economic Applications. Functions- Convexity, Concavity, Homogeneity, Homotheticity, Quasiconcavity, Quasiconcavity- economic applications	TB2: Chapters 12, 20 & 21; Notes R1: Chapters 1-4
Module 2: Linear Algebra				
2	8-11	Introduction to Linear Algebra	Economic applications, Definiteness of Matrices, Quadratic Form, Generalized Eigenvalues and Eigenvectors	TB2: Chapters 6 -9 & Notes
3	12-17	Further concepts in Linear Algebra	Partitioned Matrix, Symmetric Matrices and Properties, Cholesky decomposition, Derivatives of Functions of the Form y = Ax, Derivatives of Functions of the Form y = z' Ax	TB2: Chapters 10 &11 Notes
Module 3: Optimisation				
4	18-23	Optimisation- unconstrained and equality constraints.	Unconstrained Optimization, Necessary and Sufficient Condition, Equality Constraint, Local and Global Maximum, Envelope Theorem, Multipliers, Applications	Chapters 16-19 (TB2)
5	24-26	Optimal Control Theory	Basic Formulations, Two-period Models, Maximum Principle,	Chapters 25- R1, Notes

			Discounting, Controls	
Module 4: Foundation of Probability and Mathematical Statistics				
7	27-32	Introduction	Random variables,PDFs and CDFs, The Binomial Distribution, The Poisson distribution, Basics of Sampling- Issues and Applications in Economics, Estimation, Testing	TB1: Chapters 1-5, R4: Chapters 2,3,4,6, Notes
8	33-36	Asymptotic Behaviour of Estimators	Asymptotic Behaviour of Estimators, Markov's Inequality, Chebyshev's Inequality, The Weak law of large numbers, Convergence in probability of a random variable, Central Limit Theorems	R4: Chapters 7-8, Notes
9	37-42	Index Numbers	Basic Formulations, Laspeyres and Paasche Indices, Applications	Notes

5. Learning Outcome:

Module1: Analysis & Functions

The first module will introduce students to concepts such as open, closed and compact sets, convexity, homogeneity, homotheticity, concavity, convexity, quasiconcavity and quasiconvexity. This module will familiarize students with these basic concepts which they can apply in microeconomics and macroeconomics.

Module 2: Introduction to Linear Algebra

In this module the students will revise basic concepts of linear algebra. They will specifically grasp the application of linear algebra in econometrics, microeconomics and macroeconomics. Students will learn advanced topics such as matrix differentiation and its application in econometric theory.

Module 3: Optimisation

The final module on optimisation introduces concepts such as unconstrained optimization, necessary and sufficient condition, equality constraint, local and global maximum, envelope theorem. Students will be able to apply these concepts in microeconomics.

Module 4: Foundation of Probability and Mathematical Statistics

This module revises some of the building blocks of probability and statistical concepts. Students will also learn the applications of these basics concepts in econometrics. Further, students will also be familiarised with asymptotic behaviour of estimators and their applications in econometrics.

6. Evaluation Scheme:

EC No.	Components	Duration	Weight age (%)	Date, Time & Venue	Nature of Component
1.	Midsem	90 min.	30	13/10 - 2.00 - 3.30PM	OB
3	Quizzes	-	15	To be announced	CB
3.	Assignments/Problem sets	-	10	To be announced	OB
4.	Comprehensive Exam.	180 min.	45	19/12 FN	CB

6. **Chamber Consultation Hour:** to be announced in the class.

7. Notice: All notices pertaining to this course shall be displayed **CMS.**

8. 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 is entertained.

9. 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