

**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE-PILANI, HYDERABAD**  
**FIRST SEMESTER: 2021-22**  
**Course Handout (Part II)**

**Date: 20/08/2021**

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

<b>Course No.</b>	<b>: ECON F213</b>
<b>Course Title</b>	<b>: Mathematical and Statistical Methods</b>
<b>Instructor-in-Charge</b>	<b>: Dushyant Kumar</b>
<b>Instructors</b>	<b>: Dushyant Kumar, Prakash Kumar Shukla</b>

**1. Scope and Objective:**

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.

**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, 2017

**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, 4<sup>th</sup> Ed., 2005

**4. Course Plan:**

Topic	Lec. no.	Learning Objective	Topics to be covered	Chapter in the Text Book
<b>Module 1: Analysis &amp; Functions</b>				
1	1-6	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
<b>Module 2: Linear Algebra</b>				
2	7-10	Introduction to Linear Algebra	Economic Applications, Definiteness of Matrices, Generalized Eigenvalues and Eigenvectors	TB2: Chapters 6 -9 & Notes
3	11-14	Further concepts in Linear Algebra	Vector and Matrix Differentiation, Derivatives of Functions of the Form $y = Ax$ , Derivatives of Functions of the Form $y = z' Ax$ ,	TB2: Chapters 10 & 11 Notes
4	15-18	Basics of Linear programming & Applications	Basic Formulation, Geometric Interpretation, Simplex Algorithm	Notes
<b>Module 3: Optimisation</b>				
5	19-23	Optimisation- unconstrained and equality constraints.	Unconstrained Optimization, Necessary and Sufficient Condition, Equality Constraint, Local and Global Maximum, Envelope Theorem, Multipliers	Chapters 16-19 (TB2)
6	24-27	Optimal Control Theory	Basic Formulations, Maximum Principle, Discounting, Controls	Chapters 25- R1, Notes
<b>Module 4: Foundation of Probability and Mathematical Statistics</b>				
7	28-33	Introduction	Basics of Sampling- Issues and Applications in Economics, The Chi-Square	TB1: Chapters 1-5 & Class notes

			Distribution, The t Distribution, The F Distribution, Goodness-of-fit Tests, Tests of Independence, Finite Sample Properties of Estimators	
8	34-38	Asymptotic Behaviour of Estimators	Asymptotic Behaviour of Estimators Markov's Inequality The link between expectations and probability of an indicator function Chebyshev's Inequality The Weak law of large numbers Convergence in probability of a random variable Central Limit Theorems	Notes
9	39-42	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:**

<b>EC No.</b>	<b>Components</b>	<b>Duration</b>	<b>Weight age (%)</b>	<b>Date, Time &amp; Venue</b>	<b>Nature of Component</b>
1.	Midsem	90 min.	30	23/10/2021 11.00 - 12.30PM	OB
3	Quizzes	-	15	To be announced	OB
3.	Assignments/Problem sets	-	15	To be announced	OB
4.	Comprehensive Exam.	120 min.	40	27/12 FN	CB

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

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

**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**