

**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE-PILANI, HYDERABAD**  
**FIRST SEMESTER : 2020 - 21**  
**Course Handout (Part II)**

**Date: 17/08/2020**

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>: Bheemeshwar Reddy A</b>
<b>Instructors</b>	<b>: Dushyant Kumar, Bheemeshwar Reddy A, Prakash Kumar Shukla</b>

**1. Scope and Objective:**

This course concentrates on review of the mathematical fundamentals, statistical methods and techniques necessary for quantitative economics and finance. The course is designed to give emphasis on the application of real life examples on various fundamental issues of economics and finance.

**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	References (TB)
<b>Module1: Analysis &amp; Functions</b>				
1	1-4	Analysis & Functions-	Analysis- open, closed and compact sets, convexity, homogeneity, homotheticity Functions- concavity and convexity, quasiconcavity and quasiconvexity	TB2: Chapters 12, 20 & 21; class notes R1: Chapters 1-4
<b>Module2: Linear Algebra</b>				
2	5-10	Introduction to Linear Algebra	Matrices, Inner Product, Orthogonal Bases, and Orthogonal Matrices Determinants: Geometric Interpretation and Basic Properties Determinants of Block-Triangular Matrices, Eigenvalues and Eigenvectors of Symmetric Matrices Positive Definite and Semidefinite Matrices Generalized Eigenvalues and Eigenvectors	TB2: Chapters 6 -9 & Class notes
3	11-16	Further concepts in Linear Algebra	Vector and Matrix Differentiation Derivatives of Functions of the Form $y = Ax$ Derivatives of Functions of the Form $y = z' Ax$ Differentiation of the Trace Differentiation of Determinants Differentiation of Inverse of a Matrix	TB2: Chapters 10 & 11  Class notes
<b>Module3: Foundation of Probability and Mathematical Statistics</b>				

4	17-22	Introduction to Probability	Random Variables, Distributions, Properties of Expected Values, Variance and Conditional Expectation, Conditional Variance, The Normal Distribution, The Standard Normal Distribution, The Chi-Square Distribution, The t Distribution, The F Distribution	TB1: Chapters 1-5 & Class notes
5	23-28	Introduction to Mathematical Statistics	Populations, Parameters, and Random Sampling Finite Sample Properties of Estimators Estimation, Method of Moments, Maximum Likelihood, Least Squares Interval Estimation and Confidence Intervals Hypothesis Testing Fundamentals of Hypothesis Testing	Chapter 6-9 (TB1) & Class Notes
6	29-35	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	Class notes
<b>Module4: Optimisation</b>				
7	36-42	Optimisation- unconstrained and equality constraints.	Unconstrained optimization, necessary and sufficient condition, equality constraint, local and global maximum,	Chapters 16-19 (TB2)

			envelope theorem, multipliers	
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## 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: 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 application in econometrics.

### Module 4: 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.

## 6. Evaluation Scheme:

EC No.	Components	Duration	Weight age (%)	Date, Time & Venue	Nature of Component
1.	Test 1	30 min.	15	September 10 – September 20 (During scheduled class hour)	OB
2.	Test 2	30 min.	15	October 09 –October 20 (During scheduled class hour)	OB
3	Test 3	30 min.	15	November 10 – November 20 (During scheduled class hour)	OB
3.	Assignments/Problem sets (6-8)	-	30	To be announced	OB
4.	Comprehensive Exam.	2 hrs.	25	TBA	OB

**6. Chamber Consultation Hour:** Friday 5.00 pm to 6: 00pm .

**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**