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.

**Course No. : ECON F213**

**Course Title : Mathematical and Statistical Methods**

**Instructor-in-Charge : Bheemeshwar Reddy A**

**Instructors : Dushyant Kumar, Bheemeshwar Reddy A, Prakash Kumar Shukla**

# 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, 4th Ed., 2005

**4. Course Plan:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Topic | Lec.  no. | Learning Objective | Topics to be covered | References (TB) |
| **Module1: Analysis & Functions** | | | | |
| 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 |
| **Module2: Linear Algebra** | | | | |
| 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 |
| **Module3: Foundation of Probability and Mathematical Statistics** | | | | |
| 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 |
| **Module4: Optimisation** | | | | |
| 7 | 36-42 | Optimisation- unconstrained and equality constraints. | Unconstrained optimization, necessary and sufficient condition, equality constraint, local and global maximum, envelope theorem, multipliers | Chapters 16-19 (TB2) |

**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:**

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| --- | --- | --- | --- | --- | --- |
| **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**