Course title: Business Mathematics & Statistics			
Course code: PPM 119	**No. of credits:** 4	**L-T-P**: 2.27-1.53-0.20	**Learning hours:** 63

Pre-requisite course code and title (if any): None

Department: Policy & Management Studies

Course coordinator(s): Dr. Montu Bose	**Course instructor(s):** Dr. Montu Bose

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Course Type: Core	**Course offered in:** Semester 1

Course Description

This course gives students an exhaustive introduction to statistical methods important in business and required basic mathematical exposure for it. For last few decades India's growth rate is impressive along with high competition in the economy. Economic growth, expansion of trade and business has forced to invest in infrastructure. Given this background, businessmen can no longer rely on the old system of hit-or-miss methods or leave their future on chances. They have now to proceed on scientific principles, prepare themselves for competitive markets and plan their business accordingly. The managers have therefore to depend on a variety of factors (like present labour condition, prices of raw materials etc.). All these factors are statistically taken account of before fixing the price of new commodity or services, so that it may find a suitable place in the market. This course would be offered to M.B.A. (Sustainability Management). The course would equip the students with necessary mathematical and statistical knowledge to be ready for various managerial decisions backed by scientific evidence.

Course objectives

In the course the students would be exposed to various examples of economics and business applications. The primary objective of this course is to motivate the use of statistical analysis and at the same time encourage students to go beyond the mathematical applications of technique and to develop critical judgment through statistical analysis. The specific objectives of the course are enabling student:

To increase students understanding of economic way of thinking and analyzing to business decision making problems

- to understand the role of mathematics in statistics
- to understand and use of statistical methods ranging from graphical presentation of data to descriptive statistical representation of data for economics & business-related studies;
- to analyse data for understanding the characteristics of the business & economy related factors, their association etc.
- apply statistical techniques to forecast the market situation and to take well informed decisions.

Course content

Module	Topic	L	T	P
1	**Mathematics for Business** Introduction to matrix algebra, determinants, system of equations and solutions, calculus – limits, continuity, derivatives, integration, Maximization & Minimization, permutation & combination.	7	3	0
2	**Introduction: Data and Statistics** Introduction to Statistics, Data: Concept & types of data; importance of data in business; Data sources: introduction to business-related data & sources.	2	0	0
3	**Descriptive Statistics** Summarizing data: how to handle data scientifically to make proper decisions; Exploration & representation of business-related data: tabulation, cross tabulation, variability checking, measuring the distribution and location statistically, association among inputs and outputs; Use of diagrams in business projects and reporting.	4	3	2
4	**Probability Distribution** Introduction to set theory and probability; Additive & multiplicative rules, conditional & unconditional probability, Bayes theorem, Discrete and continuous distributions; Random variables; Discrete & continuous	5	4	0

	probability distributions: theory and its applications in management (Binomial, Poission, Negative Binomial, Geometric, Hypergeometric, Uniform, Exponential, Normal).			
5	**Sampling and Sampling Distributions** Statistical Inference: concepts & relevance in business; Methods of Sampling: purposive, random, stratified, systematic, multi-stage; Concepts and estimation of - Point Estimation, Sampling Distribution of Mean, Sampling distribution of p, sample size determination; Interval estimation, confidence interval; Determining sample size.	5	3	0
6	**Hypothesis Testing** Null and alternative hypothesis; Test of significance; Type I and Type II errors; differences of means, proportions, difference of proportions, variances, ratio of variances, Practical issues, Standard normal, χ^2, t and F distributions.	3	2	0
7	**Analysis of Variance** Introduction to analysis of variance; Assumptions and analysis of one-way classified data; Multiple comparisons, Assumptions and analysis of two-way classified data.	3	2	0
8	**Correlation and Simple linear regression – Introduction** Correlation, coefficient of correlation, Simple regression model; Least square method; Coefficient of determination; Model assumptions; Testing of significance; Predictions; Residual analysis.	3	3	4
9	**Index Numbers** Method of construction of index numbers; price and quantity index, Consumer price index (CPI) & Wholesale price index.	2	3	0
	TOTAL	**34**	**23**	**06**

Evaluation criteria:

The break-up of the evaluation procedure is as follows:

- Minor-1   : Written Examination (Module 1, 2 & 3)   -   20%
- Minor-2   : Written Examination (Module 4)   -   20%
- Minor-3   : Project Work (Primary data collection, analysis and presentation) (Module 2 -8) -   20%

[Indicators for assessment: (a) Identification of the problem; (b) Data collection; (c) Relevance of the data analysis method; (d) Representation and explanation; (e) Punctuality and timeline adherence.

Note: (a), (b) and (c) would carry a weightage of 10% each; (c) would carry 30% weightage and (d) would carry 40 % weightage.]

- Major Exam: Written Examination (Module 4 – 9)   -   40%

Learning outcomes:

After successful completion of the course, students will be able to:

- Develop a sense of the role of mathematics, statistics and data analysis in business (Minor 1, 2 and 3)
- Apply the principles, techniques and approaches for statistical inferences (Minor 3 & Major)
- Apply statistical concepts to business and economic models for predicting outcomes (All Tests)
- Application of data analysis for informed decision making (All Tests)

Pedagogical approach

The course will be delivered through lectures and tutorials. Application of statistical tools in business & economics related problems would also be a part of the pedagogical approach for the course.

References:

Textbooks:

- Anderson DR., Dennis J. Sweeney and Thomas A. Williams. Statistics for Business and Economics, Cengage Learning (latest edition), India.
- Miller CD., Salzman SA. & Clendenen G. Business Mathematics. Addison Wesley (latest edition).
- Gupta SC & Kapoor VK. Fundamentals of Mathematical Statistics, Sultan Chand & Sons. (latest edition). India.

Additional Readings:
- Kohler, H. (2010). Statistics for Business & Economics, Harper Collins.   - Levin, R. and Rubin, D. (2012). Statistics for Management, Pearson.   - McClave J. and Benson, P.G. (2013). Statistics for Business and Economics, Pearson.   - Richard I.L. and David S.R. (2011). Statistics for Management, Pearson.   - Stine R. and D. Foster (2014). Decision making and Analysis, Pearson New International Edition.   - Thukral J.K. (2015). Business Mathematics & Statistics, Mayur Paperback.   - Triola M.F. and Franklin, L.A. (2015). Business Statistics.   - Watsnam TJ. and Keith P. (2014). Quantitative Methods in Finance, International Thompson Business Press.
Additional information (If any): None
Student responsibilities: Attendance, feedback, discipline etc.

Prepared by: Dr. Montu Bose

Course reviewers:

1. Dr. Yamini Gupt, Professor, University of Delhi, Delhi.
2. Dr. Neelanjan Sen, Assistant Professor, Madras School of Economics, Chennai.
3. Dr. Tamal K. Kayal, Assistant Professor, Jadavpur University, Kolkata.