

Ambedkar University, Delhi
 Proposal for Launch of a Course
 (To be approved by the Academic Council)

School/Centre proposing the course	SUS
Programme(s)	B.A. (H) Economics
Course title	Statistical Methods for Economics
Course code	SUS1EC104
Total Credits	4
Course type (core/compulsory/ elective/any other – please specify)	Core
Level (Pre-doctoral/MA/PG Diploma /Certificate/UG)	UG
Proposed date of launch	
Course coordinator and team	

1. Does the course connect to, build on or overlap with any other courses offered in AUD?

This is an introductory course which provides a foundation for further courses in econometrics as well as for the discussion of empirical evidence in other courses.

It overlaps significantly introductory undergraduate courses in statistics offered by other disciplines.

2. Specific requirements on the part of students who can be admitted to this course: (Pre-requisites; prior knowledge level; any others – please specify)

Mathematics at the 10+2 level.

3. No. of students to be admitted (with justification if lower than usual cohort size is proposed):

As per SUS policy.

4. Course scheduling (semester; semester-long/half-semester course; workshop mode; seminar mode; any other – please specify):

Semester-long course.

5. How does the course link with the vision of AUD?

This is a basic tools course. In consonance with AUD's vision it equips students to ground their understanding of social realities in concrete facts while at the same time being aware of the limitations and blind spots of the methodologies they are employing.

6. How does the course link with the specific programme(s) where it is being offered?

The availability of data and computing power is making economics increasingly an empirical subject. The courses in the B.A. (H) Economics programme make use of statistical evidence to illustrate economic ideas wherever relevant and this course equips students to evaluate such evidence. It also provides the groundwork on which the core course on econometrics builds.

7. **Course Details:**

a. Summary:

This is an introductory course in statistics that introduces students to exploratory statistics and statistical inference as well as the use of statistical computing systems.

b. Objectives:

- i. To develop the practical skills of data exploration and visualization.
- ii. To introduce the basic ideas of probability theory used in statistics and econometrics as well as in economic theory.
- iii. To introduce students to the conceptual foundations of statistical estimation and inference.
- iv. To develop basic skills in mathematically analysing statistical procedures using tools from probability theory.

c. Expected learning outcomes:

- i. Students should be able to use standard statistical software to interactively explore data sets and to identify and present their salient features.
- ii. Students should be familiar with basic concepts from probability theory and be able to use them in calculations.
- iii. Students should be able to carry out basic estimation and inference tasks and report and interpret results in a way that shows an appreciation of the concepts involved.
- iv. Students should be aware of common pitfalls in the use and interpretation of statistical methods and be able to identify misuse of statistics in popular media as well as in published literature.

d. Overall structure (course organisation, rationale of organisation; outline of each module):

The course has three main themes — data exploration and visualization, probability theory and statistical inference — to be covered in that order. Details of the themes are given below.

e. Contents (week wise plan with readings):

Core Reading

- [MMC] Moore, D.S., McCabe, G.P. and Craig, B.A. (2009), *Introduction to the Practice of Statistics*, 6th edition, W.H. Freeman and Co.
- [MM] Millier, I and Miller, M. (2014), *John E. Freund's Mathematical Statistics with Applications*, 8th edition, Pearson.

Week	Plan/ Theme/ Topic	Objectives	Additional Suggested Readings	Assessment (weights, modes, scheduling)
1	Introduction and visualization of univariate data.	Sources of data: observational and experimental; Kinds of variables: continuous	Tufte, E. (2001). <i>The Visual Display of Quantitative Information</i> , 2 nd ed., Graphics Press; Cleveland, W.S. (1994) <i>The Elements of Graphing Data</i> , 2 nd ed., Hobart Press	

		and discrete. Histograms and frequency tables; use of statistical software.		
2	Numerical summaries of univariate data	Common measures of central tendency and dispersion; box plots; use of statistical software.		
3	Numerical summaries and visualization of bivariate data	Scatterplots; correlation coefficients; least-squares regression; use of statistical software.		Assessment 1 (10%) : Find a study reported in the news that uses statistics; report on the nature of data (observational/experimental) and the nature of variables (continuous/discrete); reproduce a graphic from the news using statistical software.
4, 5/1	Probability Axioms	Sample space and events; the axioms of probability and some of their immediate consequences; conditional probability and Bayes' theorem	Stanford Encyclopedia of Philosophy (2011), "Interpretations of Probability", https://plato.stanford.edu/entries/probability-interpret/	
5/2,6	Random Variables	Definition of a random variable; discrete and continuous random variables; distribution and density functions; multivariate distributions; marginal and conditional distributions.	Aldous, D. "Probability and the Real World" (website) https://www.stat.berkeley.edu/~aldous/Real_World/RW.html	
6, 7/1	Mathematical expectation	Definition and properties; moments; Chebychev's inequality and the derivation		Test 1 (30%): Descriptive statistics; Probability axioms; random variables

		of the weak law of large numbers; product moments; conditional expectations		
7/2,8/1	Special distributions	Discrete uniform; Bernoulli; Binomial; Uniform; Normal including the statement of the Central Limit Theorem without proof.		
8/2	Sampling distribution	Sampling and the notion of sampling distribution; Sampling distribution of the mean of an IID sample drawn from a Normal distribution with known variance.		
9	Point estimation and confidence intervals	Sampling distribution; Unbiasedness, efficiency and consistency of estimator; Construction of confidence intervals; Illustrated for the mean of an IID sample from a Normal distribution with known variance.	Salsburg, D. (1992) <i>The Lady Tasting Tea: How Statistics Revolutionized Science in the Twentieth Century</i> , Holt Paperbacks	Test 2 (30%): Mathematical expectations and special distribution.
10,11	Hypothesis tests – I	Null and alternative hypothesis; test statistics; Type I and Type II errors; P-values and statistical significance. One-sided and two-sided tests; Power	Ziliak, S.T. and McCloskey, D. (2002) <i>The Cult of Statistical Significance</i> , University of Michigan Press; Wasserstein, R. L., & Lazar, N. A. (2016). "The ASA's statement on p -values: context, process, and purpose." <i>The American Statistician</i> , 70(2), 129-133.	

		of a test and the choice between test statistics; Common pitfalls in hypothesis testing; All illustrated with tests for population mean.		
12	Hypothesis tests - II	t-test for sampling from Normal distribution with unknown variance; comparing two means; using the central limit theorem in large samples; use of statistical software.		
				Test 3 (30 %): Estimation and hypothesis testing

8. Pedagogy:

- a. Instructional strategies: Lectures. In weeks 1-3 and 12, laboratory sessions with hand-on training in the basic use of statistical software.
- b. Special needs (facilities, requirements in terms of software, studio, lab, clinic, library, classroom/others instructional space; any other – please specify): Classroom with projector. For weeks 1-3 and 12, computer laboratory with at least one computer for every two students and appropriate statistical software.
- c. Expertise in AUD faculty or outside: Capabilities exist in AUD faculty to teach this course.
- d. Linkages with external agencies (e.g., with field-based organizations, hospital; any others): None.

Signature of Course Coordinator(s)

Note:

1. Modifications on the basis of deliberations in the Board of Studies (or Research Studies Committee in the case of research programmes) and the relevant Standing Committee (SCAP/SCPVCE/SCR) shall be incorporated and the revised proposal should be submitted to the Academic Council with due recommendations.
2. Core courses which are meant to be part of more than one programme, and are to be shared across Schools, may need to be taken through the Boards of Studies of the respective Schools. The electives shared between more than one programme should have been

approved in the Board of Studies of and taken through the SCAP/SCPVCE/SCR of the primary School.

3. In certain special cases, where a course does not belong to any particular School, the proposal may be submitted through SCAP/SCPVCE/SCR to the Academic Council.

Recommendation of the School of Studies:

Suggestions:

Signature of the Dean of the School