Progressive Education Society's

Modern College of Arts, Science andCommerce Pune 16

(An Autonomous College Affiliated to Savitribai Phule Pune University)

1

Three Year B.Sc. Degree Program in

Statistics(Faculty of Science & Technology)

F. Y. B. Sc. Statistics (Minor)

Choice Based Credit System Syllabus (under NEP)

To be implemented from Academic Year 2023-2024

Modern College, Ganeshkhind, Pune

Title of the program: F. Y. B. Sc. Statistics/ Statistical Techniques

Preamble of the syllabus:

Statistics is used even by common man in everyday life knowingly or unknowingly.
In these days the knowledge of Statistics is must because a large amount of data are created because of the use of computers, social media etc. For running any type of business efficiently converting the information in the knowledge is getting more and more important. Personnel at different level can use the data with different context. But condensed data or data converted into better form i.e. valuable information enhances the efficiency of such personnel.

Whenever the variation occurs, Statistical techniques help in drawing valuable conclusions from such information. Statistics consist of various methods of collection, organization and drawing inference of data.

Whenever the variability occurs Statistics becomes indispensable tool for converting such huge information into knowledge, and hence used in almost all fields.

There is a continuous demand for statisticians in every field – education, industry, software, insurance, clinical trials data and research. The syllabus of the three Year B. Sc. degree course in Statistics is framed in such a way that the students at the end of the course can apply judiciously the statistical tools to a variety of data sets to arrive at some conclusions.

Statistics can be divided into two broad categories, (1) exploratory statistics or descriptive statistics, which is concerned with summarizing data and describing these data, and (2) confirmatory statistics or inferential statistics, which is concerned with making decisions about the population based on the sample.

B. Sc. in Statistics program is of three years duration, with semester pattern for all the three years. A student of three-year B.Sc. degree program will not be allowed to offer Statistics and Statistical Techniques simultaneously in any of the three years of the course. Students offering

At **first year of under-graduation**, students will be given the basic information that includes different methods of data representation and summarization. Correlation and regression are the forecasting tools that are frequently used in statistical analysis. These topics are studied in one of the papers in each semester. Further they are introduced to probability and different discrete probability distributions along with applications in the other paper. Relevant experiments on these topics will be included in practical course. Further the students are expected start using some statistical software and verify the computations during practical. It is a skill oriented part of the course.

At **second year of under-graduation,** students are expected to study some regression models, It is a foundation for further theory.. Some topics related to applications of Statistics will be also introduced. Further the students are expected start using some statistical software and verify the computations during practical. It is a skill oriented part of the course.

At **third year of under-graduation**, Papers such as statistical quality control.
Students will be introduced to us e of Python for handling large data. The practical courses, project component will be introduced to get hands on training or experiential learning.

Structure of the Course
Structure of the course for three years and the pattern of examination and question papers are as specified below:
Structure of F. Y. B. Sc. Statistics (Minor):

Modern College, Ganeshkhind, Pune

Level	Sem	Paper Code	Paper	Paper title	No. of credits	Marks		
						CIA	ESE	Total
4.5	I	STA11203	I	Basics of Statistics	**2**	20	30	50
		STA11407	II	Practical based on basics of statistics	2	20	30	50
	II	STA12203	I	Discrete and continuous probability distributions	2	20	30	50
		STA12407	II	Practical based on correlation, regression and probability distributions	2	20	30	50

SEMESTER – I
PAPER -I
STA11203: Basics of Statistics

(No. of Credits=02   No. of hours = 30)

Objectives:

The main objective of this course is to acquaint students with some basic concepts in Statistics. They will be introduced to some elementary statistical methods for data analysis. Objective of this course is to acquaint students with bivariate data. They willbe introduced to some methods of
analysis of bivariate data.

Course Outcomes (Cos):
CO1) Students should be able to recall basic concepts like mean, median, mode which they have learned in school and Junior college.
CO2) Students will understand the concept of population and sample, various statistical measures such as measures of central tendency, dispersion, skew-ness and kurtosis.
CO3) Students will be able to apply all the above mentioned topics in the real life.
CO5) Students will be able to create a survey design and to collect data with proper insights in the data.
CO4) Students can recall basic concepts of Probability.
CO5) Students will understand the concept of probability distribution of random variable (one or two dimensional) in the given situation.
CO6) They will learn various Discrete Probability Distributions and will apply standard discrete probability distribution to different situations.

Course Content:

Unit1: Introduction to Statistics   [02 Hours]
- Meaning of Statistics as a Science, Importance of Statistics.
- Scope of Statistics: In the field of Industry, Biological sciences, Medical sciences, Economics, Social Sciences, Management sciences, Agriculture, Insurance, Information technology, Education and Psychology.

Modern College, Ganeshkhind, Pune

3

Unit2: Population and Sample [02 Hours]

- Types of characteristics and their scale:
  - ✓ Attributes: Nominal scale, ordinal scale,
  - ✓ Variables: discrete and continuous variables, interval scale, ratio scale,
- Types of data: Primary data, Secondary data, Cross-sectional data, time series data, directional data.
- Notion of a statistical population and sample:Finite population, infinite population, homogeneous population andheterogeneous population.
- Random sample. Methods of sampling (Description only): Simple random sampling with and without replacement(SRSWR and SRSWOR) stratified random sampling, systematic sampling,

Unit3: Summary Statistics: [10 Hours]

- Presentation of Data, Interpretation of Data from table and graph, Data validation
- Frequency Classification: Raw data and its classification, ungrouped frequency distribution, Sturges' rule, grouped frequency distribution, inclusive and exclusive methods of classification, Open end classes, and relative frequency distribution, cumulative frequency distribution. Histogram and cumulative frequency curves.
- Measures of Central Tendency:
  - ✓ Concept of central tendency, Statistical averages, characteristics of a good statistical average.
  - ✓ Arithmetic Mean (A.M.): Definition, effect of change of origin and scale, combined mean of a number of groups, merits and demerits, trimmed arithmetic mean.
  - ✓ Geometric Mean (G.M.): Definition, formula, merits and demerits.Harmonic Mean (H.M.): Definition. Formula, merits and demerits.
  - ✓ Partition Values: Quartiles, Deciles and Percentiles (for ungrouped andgrouped data), Box Plot.
  - ✓ Situations where one kind of average is preferable to others.
- Measures of Dispersion:
  - ✓ Concept of dispersion, characteristics of good measure of dispersion.
  - ✓ Range, Semi-Range, Semi-interquartile range (Quartile deviation): Definition, merits and demerits.
  - ✓ Variance and standard deviation: Definition, merits and demerits, effect ofchange of origin and scale, coefficient of variation
- Concept of symmetry/skewness, positive skewness, negative skewness, Bowley's coefficient of skewness and statement of its range, interpretation usingBox plot. Karl Pearson's coefficient of skewness.

Unit4: Basics of Probability [07 Hours]

- Experiments/Models, classification of experiment as deterministic and non-deterministic/random experiment, Concept of statistical regularity.
  - ✓ Definition and types of - Sample space, event
  - ✓ Algebra of events and its representation in set theory notation.
  - ✓ Occurrence of followingevents.
    1) Simultaneous occurrence 2) Occurrence of either or 3) Occurrence of complement
- Classical definition of probability and its limitations.
- Probability model, probability of an event.
- Axiomatic definition of probability.
  - ✓ Theorems and results on probability with proofs based on axiomatic definition such as

Modern College, Ganeshkhind, Pune

4

(i)   P (AUB) =P (A) +P (B)-P (A ∩ B)

(ii) $0 \leq P(A) \leq 1$

(iii) $P(A) + P(A') = 1$

(iv) $P(\Phi) = 0$

(v) $P(A) \leq P(B)$ when A□B

(vi) Boole's inequality.

- Definition of conditional probability of an event..
- Definition of independence of two events P (A ∩ B) = P (A) ·P (B)

Unit 5: Uni and bi-variate Probability Distributions   [09 Hours]

- **Concept and definition of a discrete random variable.**

- **Probability mass function (p. m. f.), Cumulative distribution function (c. d. f.),**
  F (·), Properties, Mean and variance discrete probability distribution.

- Some standard distributions (Degenarte, Bernoulli)

Recommended Books:

Sr. No.	Title of the book	Name of Author	Publication
1	Programmed Statistics	Agarwal B. L.	Second Edition, New Age International Publishers, New Delhi.(2003)
2	Glimpses of India's Statistics Heritage	Ghosh, J. K., Mitra, S. K., Parthsarthi, K. R. -1993	Wiley publishing Co.
3	Fundamentals of Statistics	Goon, A. M., Gupta M. K. and Dasgupta, B.(1983).	Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd. Calcutta.
4	Fundamentals of Mathematical Statistics	Gupta, S. C. and Kapoor, V.K. (1983)	Eighth Edition, Sultan Chand and Sons Publishers, New Delhi (1983)
5	Fundamentals of Applied Statistics	Gupta, S. C. and Kapoor V.K.	Third Edition, Sultan Chand and Sons Publishers, New Delhi (1997)
6	Introductory Statistics	Neil A. Weiss - 2016	Tenth Edition, Pearson.
7	Statistics Made it Simple: Do it yourself on PC	Sarma, K. V. S	Prentce Hall of India, New Delhi.(2001)
8	Statistical Methods	Snedecor G. W. and Cochran W. G	Eighth Ed. East- West Press.(1989)
9	Probability and Statistics for Engineers and Scientists	Raymond Myers and Ronald E. Walpole (2007)	Pearson Education

5

Modern College, Ganeshkhind, Pune

SEMESTER – I
PAPER –II (SEC)
STA11407: Practical based on basics of statistics

No. of Credits=02   **No. of hours = 15**

List of Practicals:

Sr. No.	Title of the experiment	No. of Practical
1	Diagrammatic representation of statistical data: simple and subdivided bar diagrams, multiple bar diagram, percentage bar diagram, pie diagram using Ms-Excel	2
2	Graphical representation and interpretation of statistical data: Histogram, frequency curve and ogive curves.Using Ms-Excel and manually.	2
3	Computation of measures of central tendency and dispersion (ungrouped data) using Ms-Excel.	3
4	Measures of Skewness and Moments using Ms-Excel.	3
5	Calculation of Permutation and Combination using Ms-Excel.	1
6	Calculation of Probabilities	1
7	Survey Report/ Project	3
	Total	**15**

6

Modern College, Ganeshkhind, Pune

<u>**SEMESTER – II**</u>
PAPER –I
STA12203: Discrete and continuous probability distributions

Course Content:
Unit 1. Discrete probability distributions-I   [10 Hours]

- Discrete Uniform Distribution, Mean and Variance
- Discrete Binomial Distribution, Mean and Variance
- Real life examples of Uniform, Bernoulli, Binomial distributions
- Poisson distribution ,Mean and Variance
- Geometric distribution ,Mean and Variance ,Memory less Property
- Negative Binomial distribution , Mean and Variance
- Hyper geometric distribution ,Mean and Variance
- Real life examples of Poisson, Geometric, Negative Binomial distribution, Hypergeometric distribution

Unit 2: Some Continuous distributions   [20 Hours]

- Continuous r. v., Definition of probability density function (p.d.f.) of continuous r. v. Cumulative distribution function (c.d.f.) of continuous r.v. and their properties.
- Uniform Distribution: statement of p.d.f., mean, variance, nature of probability curve. Theorem (without proof): The distribution function of any continuous r.v. follows U(0, 1) distribution
- Exponential Distribution: statement of p.d.f. of the form(x) = $(1/\theta) e(-x/\theta)$, mean, variance, nature of probability curve, lack of memory property.(with proof)
- Normal Distribution: statement of p.d.f., identification of parameters, nature of probability density curve, standard normal distribution, symmetry, additive property, linear propery, computations of probabilities using normal probability table, normal approximation to binomial and Poisson distribution, central limit theorem (statement only), Normal probability plot. Numerical problems related to real life situations.
- Chi Square ,t, F Distributon: pdf, mean, variance, examples

Modern College, Ganeshkhind, Pune

SEMESTER – II
PAPER –II (SEC)
STA12407: Practical based on correlation, regression and probability distributions

(No. of Credits=02   No. of hours = 15)

LIST of the Practical

Sr. No.	Title of the experiment	No. of Practical
1	Measures of Correlation using MS-Excel	1
2	Simple linear Regression using MS-Excel	1
3	Multiple linear Regression using MS-Excel	2
4	Non-Linear regression: Second degree curve, exponential curve using Ms-Excel.	2
5	Computation of Binomial and Poisson probabilities.	1
6	Fitting of Binomial distribution	1
7	Fitting of Poisson distribution.	1
8	Calculation of probabilities of some continuous probabilities	1
9	Fitting of Exponential distribution	1
10	Fitting of Normal distribution	1
11	Software Report (R Software)	3
	Total	**15**

Modern College, Ganeshkhind, Pune

Reference Websites:

1. www.stats.unipune.ac.in (100 Data sets for Statistics Education by Dr. Anil P. Gore,Dr. Mrs. S. A. Paranjape and Madhav B. Kulkarni available in ISPS folder).
2. www.freestatistics.tk(National Statistical Agencies)
3. www.psychstat.smsu.edu/sbk00.htm(Onlinebook)
4. www.bmj.bmjournals.com/collections/statsbk/index.shtml
5. www.statweb.calpoly.edu/bchance/stat-stuff.html
6. www.amstat.org/publications/jse/jse-data-archive.html(International journal onteaching and learning of statistics)
7. www.amstat.org/publications/chance(Chancemagazine)
8. www.statsci.org/datasets.html(Datasets)
9. www.math.uah.edu/stat(Virtual laboratories in Statistics)
10. www.amstat.org/publications/stats(STATS : the magazine for students of Statistics)
11. www.stat.ucla.edu/cases(Case studies in Statistics).
12. www.statsoft.com
13. www.statistics.com
14. www.indiastat.com
15. www.unstat.un.org
16. www.stat.stanford.edu
17. www.statpages.net
18. www.wto.org
19. www.censusindia.gov.in
20. www.mospi.nic.in
21. www.statisticsofindia.in