Progressive Education Society's

Modern College of Arts, Science & Commerce, Ganeshkhind, Pune 411016 (Autonomous)

(NEP 2020)

Syllabus for

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

Choice Based Credit System under NEP (Version I)

to be implemented from Academic Year 2024-2025

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Preamble of the syllabus

Statistics is used even by common man in everyday life knowingly or unknowingly.

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 an 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 judiciously apply 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 a 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

In the 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 the practical course. Further the students are expected to start using some statistical software and verify the computations during practicals. It is a skill oriented part of the course.

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

At the third **year of under-graduation**, Papers such as statistical quality control. Students will be introduced to use 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 for three years and the pattern of examination and question papers are as specified below

Structure of S. Y. B. Sc. Statistics (Minor):

Level/ Sem	Paper Code	Paper (Th/P)	Paper title	No. of credits	Marks		
					CIA	ESE	Total
	24STA23204	(P)	Introduction to R software	2	20	30	50
Level V Sem IV	STA24203	(T)	Statistical Methods	2	20	30	50
	STA24204	(P)	Practical based on Testing of hypotheses using R	2	20	30	50

External Examination:

There will be a written Examination of 30 marks in 2 hrs. Duration a. for every course at the end of each Semester only for minor subjects.

Max. Marks: 30 (Credit 2, Duration: 2 Hrs.)					
Question No.	**Question**		**No. of sub questions**	**Marks to each sub question**	**Total Question Marks**
1	**Attempt All**		**5**	**1**	**5**
2	**Attempt any 5**		**7**	**2**	**10**
3	**Attempt any 2**		**4**	**5**	**10**

4	**Attempt any 1**		**2**	**5**	**5**
Total Marks:					**30**

STA24203: Statistical Methods No. of credit: 02

Unit 1: Index Numbers [8 Hours]

- Introduction and scope of Index Numbers
- Various types of Index Numbers
    - Human Development Index,
    - Happiness Index
    - BSE sensitivity Index.
- Definition and Meaning.
- Problems considerations in the construction of index numbers.
- Simple and weighted price index numbers based on price relatives.
- Simple and weighted price index numbers based on price aggregates.
- Laspeyres, Paasche's and Fisher's Index numbers.
- Consumer price index number: Methods of construction of consumer price index number
    - ★ Family budget method
    - ★ Aggregate expenditure method
    - ★ Shifting of base, splicing, deflating and purchasing power.

Unit 2: Demography [8 Hours]

- Vital events, vital statistics methods of obtaining vital statistics, rates of vital events, sex ratios, dependency ratio.
- Death/Mortality rates: Crude death rate, specific (age, sex etc.) death rate, standardized death rate (direct and indirect), infant mortality rate.
- Fertility/Birth rate: Crude birthrate, general fertility rate, specific (age, sex etc.) fertility rates, total fertility rate.
- Growth/Reproduction rates
    - ★ Gross reproduction rate
    - ★ Net reproduction rate.
- Interpretations of different rates, uses and applications.
- Trends in vital rates as revealed in the latest census.

Unit 3: .Queuing Model [6 Hours]

- M/M/1: FIFO as an application of exponential distribution, geometric distribution, Poisson distribution
- Inter arrival rate (λ), service rate (μ), traffic intensity ($\rho = \lambda / \mu$)
- Little Formulae

Unit 4: Time series [8 Hours]

- Meaning and Utility.
- Components of Time Series.

- Additive and Multiplicative models.
- Methods of estimating trend: moving average method, least squares method and exponential smoothing method.
- Elimination of trend using additive and multiplicative models.
- Simple time series models: AR (1), AR (2). 10.7 Numerical problems related to real life situations

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STA23204: Introduction to R software **No. of credit: 02**

(graphs,diagrams,mean, median mode,probability, simple linear regression, logistics fitting)

Sr. No.	Title of the experiment	No. of Practical
1	Diagrammatic representation of statistical data: simple and subdivided bar diagrams, multiple bar diagram, pie Chart	2
2	Graphical representation and interpretation of statistical data: Histogram, frequency curve and ogive curves.	2
3	Computation of measures of central tendency (ungrouped and grouped data)	2
4	Simple linear Regression	1
6	Logistic Regression	1
7	Computation of Probabilities	2
8	Survey Report/ Project	5
	Total	15

Books Recommended

Sr. No.	Name of the book	Author	Pubklication
1	Statistics - An introduction using R.	Crawley, M. J. (2006).	John Wiley, London
2	Statistics using R	Purohit, S.G.; Gore, S.D. and Deshmukh, S.R. (2015).	second edition. Narosa Publishing House, New Delhi.

3	Using R for Introductory Statistics	Verzani, J. (2005)	Chapman and Hall /CRC Press, New York

STA24203: Testing of hypotheses No. of Credits: 02

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Unit 1: Introduction to the testing [3 Hours]

- Random sample from a distribution as . r.vs. , ...
- Statistic and Parameter.
- Sampling distribution , standard error of a statistic with illustrations. Statistical Inference:
- Examples of statistics, parameters and sampling distribution.
- Introduction to the problem of Estimation and testing of hypotheses.
- Estimator and estimate. Unbiased estimator (definition and simple illustrations only) (proof on the basis of population of 4 observation s and using sampling method SRSWOR ,SRSWR)
- Point and interval estimation.

Unit 2:Tests of Significance:

[15 Hours]

- Statistical hypothesis, null and alternative hypothesis, simple and composite hypothesis, one sided and two sided alternative hypothesis,critical region and acceptance region type I error ,type II error, level of significance.
- Tests of hypotheses using
  - ★ critical region approach
  - ★ confidence interval approach.
- Tests for population means (large sample / approximate tests):
  - ★ single population(two sided, variance known)
  - ★ two populations(two sided, variance known)
  - ★ Construction of two sided confidence interval for μ and $\mu 1 - \mu 2$
- Tests for population means (small sample / exact test):
  - ★ t test for single population mean(two sided, variance unknown)
  - ★ t test for two populations(two sided,, variance known)
  - ★ Paired t test
- Chi square test
  - ★ Single population variance

- ★ Independence of attributes
- ★ Goodness of fit

- F test for Tests for population variance (small sample / approximate tests):
  - ★ Two population variances
  - ★ One way ANOVA
- Tests for population proportions:
  - ★ single population(two sided, one sided test
  - ★ two population(two sided, one sided test
  - ★ Construction of two sided confidence interval for □ □□□ □1 − □2

Unit 3: SPRT Bernoulli, Exponential for mean [3 hours]

Unit 4: Non-parametric Tests [6 Hours]

- Concept of non-parametric tests. Distinguish between parametric and non parametric Tests.
- Concept of distribution free statistics.
- One tailed and test procedure of
  - ★ Sign test
  - ★ Shapiro test
  - ★ Wilcoxon signed rank test for single population
  - ★ Run test, one sample and two samples problems

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STA24204 : Practical based on testing using R software No. of Credits: 02

Sr No	Title	No of Practicals
1	Programming in R Statements: if and if… else, for loop, cat and print commands. Comment on skewness and kurtosis	2
2	Test of hypothesis: Mean test (one and two large samples)	1
3	Test based on t test (mean test ,Paired t test)	1
4	Test of hypothesis: Proportionality test	1

5	Chi square test for independence of attributes and goodness of fit test.	2
6	Test based on F distribution	1
9	ANOVA test	1
10	Project	5
	TOTAL	15