Savitribai Phule Pune University

(Formerly University of Pune)

REVISED SYLLABUS

OF

S. Y. B. A.

STATISTICAL PRE-REQUISITES (General)

Choice Based Credit System Syllabus

With Effect from June 2020

Preamble:

Statistics is used in different ways in different contexts. For a cricket fan, Statistics is the information about runs scored or wickets taken by a player. For the manager of a manufacturing unit, Statistics may be the information about the production/manufacturing process. For a medical researcher, investigating the effects of a new drug, Statistics is the evidence of research efforts. For a college student, Statistics shows the grades or marks scored in a course. Thus, in all these examples, Statistics refers to quantitative data in the area under study. Statistics as a subject is an important branch of knowledge and is devoted to various techniques of collection, presentation, analysis and interpretation of data. It is a science of learning from data. The subject provides tools for making decisions when conditions of uncertainty prevail. Hence Statistical tools and techniques are used in almost all fields such as agriculture, business, management, economics, finance, insurance, education, sports, biotechnology, medical science, etc. For the last two decades, large amount of data has been collected with the help of computers and more sophisticated statistical techniques are needed for the effective analysis and meaningful conclusions from these data. Knowledge of different aspects of Statistics has become crucial in the present technologically advanced scenario. There is a continuous demand for statisticians in fields of education, industry, software and research. The syllabi of three-year B.A. (special) degree course in Statistics are framed in such a way that the students at the end of the course are thorough in basic statistical techniques and are ready to pursue a Master degree and/or simultaneously able to seek jobs involving statistical analysis related to a variety of data sets in order to arrive at some valid conclusions.

Note: (1) A student of the Three-Year B.A. Degree Course offering 'Statistics' at the special level must offer 'Mathematical Statistics' as a General level subject in all the three years of the course. Further students of the three-year B.A. Degree Course are advised not to offer 'Statistics' as the General level unless they have offered 'Mathematical Statistics' as a General level subject in all the three years of the course.

(2) A student of three-year B.A. Degree Course offering 'Statistics' will not be allowed to offer 'Applied Statistics' and 'Statistical Pre-requisites' in any of the three years of the course.

(3) A student offering 'Statistics' at the Special level must complete all practicals in Practical Paper to the satisfaction of the teacher concerned.

(4) He/ She must produce the laboratory journal along with the completion certificate signed by the Head of the Department at the time of Practical Examination.

(5) Structure of evaluation of practical paper at S.Y.B.A. Statistics:

A) Continuous Internal Assessment (CIA):

Section	Marks
i) Journal ii) Viva-voce iii) Project	20 05 05
Total of CIA	30

B) End of Semester Examination (ESE):

Section	Nature	Marks	Time
I	On line examination: Note: Question No.1 is compulsory. Q. 1: Execute the commands and write the same in answer book along with answers using: (A) $Ms - EXCEL$ (For Sem-III) (B) $R - Software$ (For Sem-IV)	 10 10	Maximum 30 minutes
II	Using Calculator / Computer Note: Attempt any two of the four questions (each of 25 marks): Q2, Q3, Q4 and Q5.	50	*****3 hours And ^2hrs 30
III	Viva-voce	10	10 minutes
	Total of B	**70**	#

Foot note:

* For calculator user

^ For computer user

Total examination time 3 hours 40 minutes for calculator user and 3hours 10 minutes for computer user.

(6) Structure of evaluation of theory paper at S.Y.B.A. Statistics (special and general), Applied statistics and Statistical pre-requisites:

A) Continuous Internal Assessment (CIA) for theory subjects:

Section	Marks
i) Theory examination ii) Home assignment iii) Seminar/class test etc.	20 05 05
Total of CIA	30

B) End of Semester Examination (ESE) for theory subjects:

Question	Nature	Marks
1	a) Choose correct alternative: i) ii) iii) iv) v) (each with four multiple choice answer A, B, C, D) b) True or false: i) ii) iii) iv) v)	5 5
2	Attempt any four of the following: a) b) c) d) e) f)	20
3	Attempt any four of the following: a) b) c) d) e) f)	20
4	Attempt any two of the following: a) b) c) d)	20
	Total ESE	**70***

Foot note:

* Numerical problem should not exceed 40% of total marks with option questions.

S.Y.B.A. STATISTICS Syllabus
For Choice Based Credit System-2019 pattern
To be implemented from the Academic year 2020-2021
Structure of the course:

Table with code and Title for CBCS 2019 pattern:

Subject	Semester III			Semester IV		
	Code	**Title**	**Credit**	**Code**	**Title**	**Credit**
Statistics General-I	ST-23873	Sampling Techniques **(CC 1C)**	3	ST-23874	Statistical Quality Control **(CC 1D)**	3
Statistics Special-I	ST-23883	Continuous Probability Distributions **(DSE 1A)**	3	ST-23884	Sampling Distributions and Inference **(DSE 1B)**	3
Statistics Special-II	ST-23893	Statistics Practical **(DSE 2A)**	3	ST-23894	Statistics Pract. **(DSE 2B)**	3
Mathematical Statistics General-II	ST-23273	Discrete Prob. Distributions and Time Series **(CC 2C)**	3	ST-23274	Tests of Significance and Statistical Methods**(CC2D**	3
Skill Enhancement Course**(SEC)**		**General subject other than Statistics (SEC 1A)**	3		**General subject other than Statistics (SEC 1B)**	3
Skill Enhancement Course**(SEC)**		Data Handling Through MS-Excel **(SEC 2A)**	2		Data Handling Through R-software**(SEC 2B)**	2
Statistical Prerequisites	ST-23573	Applications of Statistics and Theory of Prob. **(SEC 1A)**	3	ST-23574	Theory of Prob. Distributions **(SEC 1B)**	3
Applied Statistics	ST-24173	Applications of Statistics and Theory of Prob. **(SEC 1A)**	3	ST-24174	Discrete Prob. Distributions & Demography **(SEC 1B)**	3

SYBA
SEMESTER -III
Statistical Pre-requisites(General)

Note: (1) Statistical Pre-requisites can be offered only as a General level subject.
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SYBA
SEMESTER -III
Subject: Statistical Pre-requisites(General)

ST-23573: Applications of Statistics and Theory of Probability (SEC-1A)

Unit 1. Multiple regression plane, multiple and partial correlation coefficient (using tri-variate data): (10)

(No proof is required for the derivation of the equation of multiple regression plane)

1.1 Notion of multiple regression.

1.2 Equation of Multiple regression model: $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$

1.3 Obtaining the equation of plane of regression given:

i) the means, standard deviations and total correlation coefficients and obtaining the estimated value.

ii) sums, sums of squares and sum of squares of deviations from respective mean etc. and obtaining the estimated value.

1.4 Notion of multiple and partial correlation.

1.5 Definition of multiple correlation coefficient ($R_{Y.X1X2}$) and partial correlation coefficient ($r_{YX1.X2}$ *and* $r_{YX2.X1}$) .Expressions in terms of total correlation coefficients.

1.6 Concept of multiple coefficient of determination and partial coefficient of determination with interpretation.

Unit 2. Time Series: (15)

2.1 Meaning of Time Series

2.2 Various components of a time series (Explanation and illustrations of each component)

2.3 Additive and multiplicative models of time series.

2.4 Meaning and usefulness of time series analysis.

2.5 Methods of estimating trends: (i) Freehand or graphical method (ii) Method of least square (line and second degree curve) (iii) Method of semi-averages (iv) Method of moving averages.

2.6Methods of estimating seasonal components:

(i) Methods of simple averages. (ii) Ratio to trend obtained by moving averages.

2.7 Auto regression model, Fitting of AR(1)model.

Unit 3. Elements of Demography: (8)

3.1 Introduction to demography, need of vital statistics and methods of obtaining vital statistics.

3.2 Mortality Rates: Crude Death Rate(CDR), Age-specific death rates(ASDR), Standardized Death Rate(STDR) (Direct and indirect method).

3.3 Fertility and Reproduction Rates: Crude Birth Rate (CBR), General Fertility rate(GFR), Age-specific Fertility Rate(ASFR). Total Fertility Rate(TFR),Gross Reproduction rate(GRR), Net Reproduction Rate(NRR).

Unit 4. Probability: (15)

4.1 Revision of set theory. Concept and definition of union, intersection of two sets, co1mplement of a set. Permutation and Combination (for distinct objects) (no problem should be asked on this topic in the examination)

4.2 Concept of random experiment, sample space with its types.

4.3 Event and types of event: complementary event, elementary event, certain event, impossible event, mutually exclusive events and exhaustive events.

4.4 Classical definition of probability and its limitations.

4.5 Probability model.

4.6 Axioms of probability.

4.7 Theorems of Probability **(Without proof explain only through illustrations)**

(i) $P(A) + P(A') = 1$. (ii) $0 \leq P(A) \leq 1$. (iii) $P(\Phi) = 0$. (iv) If $A \subset B$ then $P(A) \leq P(B)$.

(v) Total probability theorem/Addition theorem on two events

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$. (vi) Statement for 3 events for total probability theorem

(vii) $P(A \cup B) \leq P(A) + P(B)$, (Boole's inequality).

4.8 Definition of conditional probability.

4.9 Particular cases of $P(A \mid B)$ when $A \subset B$ or $B \subset A$ or $A \cap B = \Phi$.

4.10 Multiplication theorem on P(A∩B).

4.11 Concept and definition of independence of two events.

4.12 Pair-wise independence and complete independence in case of three events.

References:

1. G. Gupta and D. Gupta: Fundamental of Statistics, Vol.II, Shripati Bhattachrjee for the World Press Pvt. Ltd, Calcutta.
2. J.V.Uspensky: Introduction to Mathematical Probability.
3. Lipschutz : Probability and Statistics, Schaum's Outline Series,New York.
4. M.G.Kendall and Stuarr : Advanced theory of Statistics, Vol. I, Allan.
5. M. Siegleman : Introduction to Demography .
6. S.C.Gupta and V.K.Kapoor: Fundamentals of Applied Statistics, Sultan Chand and Sons, New Delhi.
7. Walpole and Myres: Probability and Statistics, Mcmillan Publishing Co. New York.
8. Introduction to Linear Regression Analysis, Douglas C. Montgomery, Elizabeth A. Peck, G.Geoffrey Vining, Wiley
9. Time Series Methods, Brockwell and Davis, Springer, 2006.
10. Time Series Analysis,4th Edition, Box and Jenkin, Wiley, 2008.
11. A First course in Probability, Sheldon Ross.Pearson Education Inkc.
12. Statistical Methods (An IntroductoryText), Medhi J., New Age International.
13. Modern Elementary Statistics, Freund J.E. 2005, Pearson Publication.
14. Fundamentals of Mathematical Statistics (3rd Edition), Gupta S. C. and Kapoor V. K.1987 S. Chand and Sons, New Delhi.
15. Mathematical Statistics (3rd Edition), Mukhopadhyay P. 2015, Books and Allied (P), Ltd.
16. Programmed Statistics, B.L. Agarwal, New Age International Publishers

SYBA
SEMESTER –IV
Statistical Pre-requisites(General)

Note: (1) Statistical Pre-requisites can be offered only as a General level subject.
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SYBA
SEMESTER -IV
Subject: Statistical Pre-requisites(General)

ST-23574: Theory of Probability Distributions (SEC 1B)

Unit 1. Univariate discrete probability distributions: (10)

1.1 Definition of a discrete random variable (r.v.)

1.2 Definition of probability mass function (p.m.f.) of a discrete r.v, cumulative distribution function(c.d.f.) and its properties.

1.3 Definition of expectation of a discrete r.v. and expectation of a linear function of discrete r.v. Mode and median of discrete r.v.

1.4 Definition of variance of discrete r.v.

Unit 2. Bivariate Probability Distributions: (18)

2.1 Definition of two-dimentional discrete r.v. ,its joint probability distribution /p.m.f.

2.2 Computation of probabilities of events in bivariate probability distributions.

2.3 Concepts of marginal and conditional probability distributions.

2.4 Independence of two discrete r.vs.

2.5 Definition of mathematical expectation of function of two dimensional discrete r.v.

2.6 Definitions of conditional mean and conditional variance.

2.7 Definition of covariance and correlation coefficient (ρ).

2.8 Effect of change of origin and scale on covariance and coefficient of correlation (only Statement).

2.9 Variance of linear combination of two-dimensional discrete r.v, Var(aX+bY (only Statement).

Unit 3. Special Discrete Probability Distributions: (20)

3.1 Discrete uniform distribution: p.m.f. mean and variance (only statement). Illustrations of real life situations where this distribution can be applied.

3.2 Hypergeometric distribution: X~H(N,M,n) p.m.f., mean and variance (only statement) Illustrations of real life situations where this distribution can be applied. Computation of probabilities of events related to hypergeometric r.v.

3.3 Binomial distribution: Notation X~B(n,p). p.m.f., mean, mode and variance, additive property (derivations excluded). Illustrations of real life situations where the distribution can be applied. Hypergeometric distribution approximation to binomial distribution (only statement). Computation of probabilities of events related to binomial r.v.

3.4 Poisson distribution: Notation X~P(m) p.m.f., mean and variance, additive property (derivations excluded), Illustrations of real life situations where the distribution can be applied. Binomial distribution approximation to Poisson distribution (only statement). Computation of probabilities of events related to a Poisson r.v.

References:

1. G. Gupta and D. Gupta: Fundamental of Statistics, Vol.II , Shripati Bhattachrjee for the World Press Pvt. Ltd, Calcutta.
2. J.V.Uspensky: Introduction to Mathematical Probability.
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4. M.G.Kendall and Stuart : Advanced theory of Statistics, Vol. I, Allan.
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