Fergusson College (Autonomous)
Pune

Learning Outcomes-Based Curriculum
For

F.Y.B. A. Applied Statistics

With effect from June 2019

Programme Structure

F.Y. B.A.		
Semester	**New CBCS Pattern**	**Old /Existing Pattern**
Sem I	**STA1101** Descriptive Statistics – I **(Credits 02)**	**STA1101** Descriptive Statistics – I **(Credits 02)**
Sem II	**STA 1201** Descriptive Statistics – II **(Credits 02)**	**STA 1201** Descriptive Statistics – II **(Credits 02)**
S.Y. B.A.		
Sem III	**STA2301** Probability Theory and Discrete Probability Distributions **(Credits 03)**	**STA2301** Probability Theory and Discrete Probability Distributions **(Credits 03)**
Note: SEC 1C is CC '1 or 2' (General paper for other department students)		
Sem IV	**STA2401** Continuous Univariate Distributions and Applications of Statistics **(Credits 03)**	**STA2401** Continuous Univariate Distributions and Applications of Statistics **(Credits 03)**
SEC 1B is CC-'1 or 2' (General paper for other department students)		
T.Y. B.A.		
Semester	**New CBCS Pattern**	**Old /Existing Pattern**
Sem V	**STA3501** Testing of Hypotheses (General) **(Credits 03)**	**STA3501** Testing of Hypotheses (General) **(Credits 03)**
Note: SEC 1C is CC '1 or 2' (General paper for other department students)		
Sem VI	**STA3601** Sampling Theory(General) **(Credits 03)**	**STA3601** Sampling Theory (General) **(Credits 03)**
Note: SEC 1D is CC-'1 or 2' (General paper for other department students)		

F.Y. B.A. Semester I		
Title of the Course and Course Code	**STA1101** **Descriptive Statistics - I**	**Number of Credits : 03**
	Course Outcomes (COs) **On completion of the course, the students will be able to:**	
CO1	Recall statistical population and sample, need of Statistics and information about National Statistical Institutes.	
CO2	Articulate the data, its types and summarize information in the data using different measures.	
CO3	Apply methods and procedures of summarizing information in real life situations in different fields	
CO4	Classify various types of indices.	
CO5	Assess preliminary judgments and comparisons through exploratory data analysis and summary measures.	
CO6	Construct different types of indices.	

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 of analysis of data. At the end of this course students are expected to be able,
(i) to compute various measures of central tendency, dispersion, skewness and kurtosis.
(ii) to analyze data pertaining to attributes and to interpret the results.
(iii) to compute and interpret various index numbers.

Unit. No.	Title of Unit and Contents	No. of Lectures
I	**Introduction to Statistics** Meaning of Statistics as a Science, Importance of Statistics, Scope of Statistics: In the field of Industry, Economics, Social Sciences, Management sciences, Agriculture, Insurance, Information technology, Education and Psychology Biological sciences, Medical sciences, Statistical organizations in India and their functions: CSO, ISI, NSS, IIPS (Devnar, Mumbai), Bureau of Economics and Statistics.	4
II	**Population and Sample** Types of characteristics: Attributes: Nominal scale, Ordinal scale, Variables: Interval scale, Ratio scale, discrete and continuous variables, difference between linear scale and circular scale Types of data: (a) Primary data, Secondary data (b)Cross-sectional data, time series data. Notion of a statistical population: finite population, infinite population, homogeneous population and	6

		heterogeneous population. Notion of a sample and a random sample, Methods of sampling (description only): Simple random sampling with and without replacement (SRSWR and SRSWOR), stratified random sampling, systematic sampling, cluster sampling and two-stage sampling.	

III	**Summary Statistics**
	
	Review / Revision of Presentation of Data,
	
	Classification: Raw data and its classification,ungrouped frequency distribution, Sturges' rule, grouped frequency distribution, cumulative frequency distribution, inclusive and exclusive methods of classification, Open end classes, and relative frequency distribution,
	 Measures of Central Tendency
	     Review / Revision of following topics: Concept of central tendency of statistical data, 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, mode and median:
	     Definition, formulae,
	     merits and demerits. Empirical relation
	     between mean, median and mode .
	     Partition Values: Quartiles, Deciles and Percentiles, Box Plot.
	     Geometric Mean (G.M.): Definition, formula, merits and demerits. Harmonic Mean (H.M.):
	     Definition. Formula, merits and demerits.
	     Orderly relation between arithmetic mean, geometric mean, harmonic mean Weighted Mean: weighted A.M.,
	     G.M. and H.M. Situations where one kind of average is
	     preferable to others,
	 Measures of Dispersion
	  Review / Revision of following topics:
	     Concept of dispersion, characteristics of good measure of
	dispersion.
	Range, Semi-interquartile range (Quartile deviation): Definition, merits and demerits,
	Mean deviation,
	Definition, merits and demerits, minimality property(without proof),
	Variance and standard deviation:
	     Definition, merits and demerits, effect of change of
		16	

		origin and scale, combined variance for n groups (derivation for two groups). Mean squared deviation: Definition, minimality property of mean squared deviation (without proof), Measures of dispersion for comparison: coefficient of \ range, coefficient of quartile deviation and coefficient of mean deviation, coefficient of variation (C.V.)	
IV		**Moments, Skewness and Kurtosis** Raw moments (m'_r) for ungrouped and grouped data, Central moments (m_r) for ungrouped and grouped data, Effect of change of origin and scale, Relations between central moments and raw moments, upto 4th order (without proof), Concept of skewness of frequency distribution, positive skewness, negative skewness, symmetric frequency distribution, Bowley's coefficient of skewness : Bowley's coefficient of skewness lies between -1 to 1 (with proof), interpretation using Box plot, Karl Pearson's coefficient of skewness, Measures of skewness based on moments (β_1, γ_1), Concepts of kurtosis, leptokurtic, mesokurtic and platykurtic frequency distributions Measures of kurtosis based on moments (β_2, γ_2).	10
V		**Index Numbers** Introduction, 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 aggregates, Laspeyre's, Paasche's and Fisher's Index numbers, Consumer price index number: Considerations in its construction. Methods of construction of consumer price index number – (i) family budget method (ii) aggregate expenditure method. Shifting of base, splicing, deflating, purchasing power, Description of the BSE sensitivity and similar index numbers.	12

References:

1. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
2. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition,The World Press Pvt. Ltd., Calcutta.
3. Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
4. Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, New Delhi.
5. Freund, J. E. (1977). Modern Elementary Statistics. Fourth Edition, Prentice Hall of India Private Limited, New Delhi.
6. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentce Hall of India, New Delhi.
7. Snedecor G. W. and Cochran W. G.(1989). Statistical Methods, Eighth Ed. East-West Press.

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<table>
<tr><td colspan="3" align="center">**F.Y. B.A. Semester II**</td></tr>
<tr><td>**Title of the Course and Course Code**</td><td align="center">**STA1201**
Descriptive Statistics - II</td><td>**Number of Credits : 03**</td></tr>
<tr><td colspan="3" align="center">**Course Outcomes (COs)**
On completion of the course, the students will be able to:</td></tr>
<tr><td>CO1</td><td colspan="2">Describe the concept of bivariate data theory of attributes and Time Series.</td></tr>
<tr><td>CO2</td><td colspan="2">Compute Karl Pearson's coefficient of correlation and Spearman's rank correlation coefficient and obtain lines and curves of regression.</td></tr>
<tr><td>CO3</td><td colspan="2">Apply different methods to obtain the trend of the Time Series.</td></tr>
<tr><td>CO4</td><td colspan="2">Differentiate between correlation and regression.</td></tr>
<tr><td>CO5</td><td colspan="2">Consider and justify the use of correlation, regression and different methods to estimate components of Time Series.</td></tr>
<tr><td>CO6</td><td colspan="2">Arrange different real life situations as time series objects.</td></tr>
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Objectives: the main objective of this course is to acquaint student with concept of bivariate data. They will be introduced to some elementary statistical method to analyse the bivariate data.

(i) to fit linear, quadratic and exponential curves to the bivariate data to investigate relation between two variables.
(ii) to fit linear regression model to the bivariate data
(iii) to compute the correlation coefficient for bivariate data and interpret it.

Unit No.	Title of Unit and Contents	No. of Lectures
I	**Correlation** Bivariate data, Scatter diagram and interpretation, Concept of correlation between two variables, positive correlation, negative correlation, no correlation, Covariance between two variables (m_{11}) ,Definition, computation, effect of change of origin and scale, Karl Pearson's coefficient of correlation (r) : Definition, computation for ungrouped data and interpretation. Properties: (i) $-1 \le r \le 1$ (without proof), (ii) Effect of change of origin and scale (without proof), Spearman's rank correlation coefficient: Definition, derivation of formula, computation and interpretation (without ties). In case of ties, compute Karl Pearson's correlation coefficient between ranks. (Spearman's rank correlation coefficient formula with correction for ties not expected.)	10
II	**Linear Regression Model** Meaning of regression, difference between correlation and regression, Concept of error in regression, error modeled as a continuous random variable. Simple linear regression model: Y= a + b X + ε, where ε is a continuous random variable with E(ε)	9

	$=0$, $V(\varepsilon) = \sigma^2$, Estimation of a, b by the method of least squares, Interpretation of parameters. Statement of the estimator of σ^2. Concept of residual, plot of residual against X, concept of coefficient of determination.	
III	**Fitting of curves to the bivariate data** Fitting of line ($Y = a + b X$), Fitting of second degree curve ($Y = a + b X + c X^2$), Fitting of exponential curves of the type $Y = a b^X$ and $Y = aX^b$, In all these curves parameters are estimated by the method of least squares.	
IV	**Theory of Attributes** Attributes: Concept of a Likert scale, classification, notion of manifold classification, dichotomy, class-frequency, order of a class, positive class- frequency, negative class frequency, ultimate class frequency, relationship among different class frequencies (up to three attributes), and dot operator to find the relation between frequencies, fundamental set of class frequencies, Consistency of data upto 2 attributes. Concepts of independence and association of two attributes, Yule's coefficient of association (Q), $-1 \leq Q \leq 1$ interpretation.	

V	**Time Series**
	Meaning of Time Series
	Various components of a time series (Explanation and illustrations of each component)
	Additive and Multiplicative methods for analysis of a time series
	Methods of estimating trends
	    (i) Freehand or Graphical method
	    (ii) Method of semi-averages
	    (iii) Method of moving averages
	    (iv) Method of least squares
	Simple numerical problems.
		12

References:

1. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
2. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition,The World Press Pvt. Ltd., Calcutta.
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7. Snedecor G. W. and Cochran W. G.(1989). Statistical Methods, Eighth Ed. East- West Press.