UNIVERSITY OF PUNE

Circular No. 253 of 1996.

Subject :- Revised Syllabus for F.Y. B.Sc.
Statistical Techniques.

In pursuance of the decision taken by the University authorities, it is hereby notified for the information of all concerned that the revised syllabus for F.Y.B.Sc. Statistical Techniques is as given in Appendix 'A'.

The revised syllabus will be implemented from the Academic year 1996-97.

The Principals of all affiliated Colleges in Science, where Statistical Techniques is taught are requested to bring the contents of this circular to the notice of all concerned teachers and students.

Ganeshkhind,
Pune-411 007.
Ref.No. CB/350
Date : 29.7.1996.

For Registrar

To,

The Principals of all affiliated Science Colleges.

Copy f.w.cs to for information :-

1. The Dean, Faculty of Science
2. The members of the Boards of Studies in Statistics.
3. The Controller of Examinations.
4. The Director B.C.U.D.
5. The Director Competative Exam.Centre.
6. The Dy.Registrar (1,2,3,4)
7. The System Analysis, D.P.U.
8. The Dy.Registrar, Admission

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9. The Asstt.Registrar (Examination-Co-Ordination .
10. The Asstt.Registrar, S.& T Unit
11. The Asstt.Registrar (Strong Room)
12. The Asstt.Registrar,Foreign Students Cell
13. The Public Relation Officer
14. The Asstt.Registrar (Admission)
15) The Asstt. Registrar,Sub-Centres,Ahmednagar,Nashik.
16. The Section Officer,Eligibility.
17. The Asstt.Registrar,External
18. The Section Officer, Publication

Authority :- AC B.32 PA/32/96 dated 19.2.1996 & 7.3.96.

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UNIVERSITY OF PUNE

F.Y. B.Sc. Statistical Techniques

Notes :-

1. A student of the Three Year B.Sc. degree course will not be allowed to offer Statistics and Statistical Techniques simultaneously in any of the three years of the course.
2. Students offering Statistics at the first year of the Three Year B.Sc. Course may be allowed to offer Statistical Techniques as one of their subjects in the second year of the Three year B.Sc. Course in the place of Statistics.
3. Students offering Statistical Techniques at the first year of the Three Year B. Sc. Course may be allowed to offer Statistics as one of their subjects in the second year of the Three Year B.Sc. Course in place of Statistical Techniques provided they satisfy other requirements regarding subject combinations, if any.
4. Students must complete all the Practical in each Practical Paper to the satisfaction of the teacher concerned.
5. Students must produce at the time of the Practical examination the laboratory journal alongwith the completion certificate signed by the Head of the Department.
6. For each Practical peper examination 10 marks are reserved for viva-voce and journal.

PAPER III- Practical

Prerequisites : Knowledge of the topics in Theory Papers.

Objectives :

At he end of this course students are expected to be able-

i) to compute various measures of central tendency, dispersion, skewness and kurtosis,

ii) to compute correlation coefficient, regression coefficient,

iii) to fit binomial distribution,

iv) to analyse data pertaining to discrete and continuous variables and to interpret the results,

v) to compute index number and

vi) to compute probabilities of bivariate distributions.

REVISED / SYLLABUS FOR F.Y B.SC. STATISTICAL TECHNIQUES

to be implemented from June 1996.

Paper-I : Descriptive Statistics :

Objections :

The main objective of this course is to acquaint students with some basic concepts in Statistics. They will be introduced to some elementry statistical notbods of analysis of data.

At the end of this course students are expected to be able (i) to and interprete (i)/various measures of central tendency, dispersion, skewness and kurtosis, (ii) the correlation coefficient and regression coefficients from bivariate data and iii) to compute the index numbers and also to tabulate and analyse data pertaining to attributes.

Contents :

1. Introduction to Statistics : (4)

1.1 Definitions : Webster's Lowley's Yle and Kendall's and Secrist's definitions of Statistics.

1.2 Importance of Statistics.

1.3 Scope of Statistics : in industry, biological sciences, medical Science s,economics, social sciences. management sciences.

1.4. Statistical organisations in India; CSO, ISI, NSS, Beaurau of Economics and Statistics, their names and functions.

2. Population and Sample :

2.1 Notion of a statistical population, types of populations and a sample from a population with illustrations.

2.2 Description of simple random sampling with and without replacement (SRSWR and SRSWOR), stratified random sampling, systematic sampling, cluster sampling, two stage sampling.

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3. Types of Statistical Data : (3)

3.1 Attributes : nominal scale and ordinal scale.
Variables : discrete and continuous variables, raw data

3.2 Classification : Discrete frequency distribution, continuous frequency distribution, inclusive and exclusive methods of classification, cumulative frequency distribution, relative frequency.

3.3 Graphical representation of statistical data : Histogram, frequency polygon and frequency curve, ogive curves.

3.4 Examples and problems.

4. Tabulation : (3)

4.1 Definition of tabulation.

4.2 Construction of statistical tables : Parts of table, rules of tabulation, uses of tabulation. Construction of tables with one, two and three factors of classifications.

4.3 Requirements of a good statistical table.

4.4 Examples.

5. Measures of Central Tendency : (10)

5.1 Concept of central tendency of statistical data : statistical average. Requirements of a good statistical average.

5.2 Arithmetic Mean (A.M.) : Definition effect of change of origin and scale, combined mean of a number of groups, merits and demerits.

5.3 Geometic Mean (G.M.) : Definition, merits and demerits

5.4 Harmonic Mean (H.M.) : Definition, merits and demerits

5.5. Mode : Definition, formula for computation (without derivation), graphical method of determination of mode merits and demirits.

5.6 Median : Definition, formula for computation (without derivation), graphical method of determination of median, merits and demerits.

5.7. Empirical relation between mean, median and mode.

5.3. Partition values : Quartiles, Deciles and Percentiles.

5.9 Weighted Means : Weighted A.M.,G.M. and H,M

5.10 Situtations where one kind of average is preferable to others.

5.11 Examples and problems.

6. Measures of Dispersion : (10)

6.1 Ceoncept of dispersion, Requirements of a good measure of dispersion.

6.2 Range : Definition, merits and demerits.

6.3 The semi-interquartile range (quartile deviation)

6.4 Mean Deviation : Definition, merits and demerits, minimal property (without proof)

6.5 Mean Square Deviation : Definition, minimal property of mean square deviation, variance and standard deviation : Definition, merits and demerits, effect of change of origin and scale, statement of combined variance and standard deviation.

6.6 Absulute and relative measures of dispersion, coefficient of quartile deviation, coefficient of variation (C.V.)

6.7. Examples and Problems.

7. Moments : (5)

7.1 Moments about an arbitrary constant.

7.2 Raw moments (m/r) for ungrouped and grouped data

7.3 Central moments (m/r) for ungrouped and grouped data, Sheppard's corrections, effect of change of origin and scale.

7.4 Relations between central moments and raw moments.

7.5 Examples and Problems.

8. Skewness :

8.1 Concepts of skewness of a frequency distribution, positive skewness, negative skewness, symmetic distributions.

8.2 Bowley's coefficient of skewness : Proof that Bowley's coefficient of skewness lies between - 1 to 1.

8.3 Karl Pearson's ø coefficient of skewness

8.4 Measures of skewness based on moments.

8.5 Examples and Problems.

9. Kurtosis : (1)

9.1 Concepts of Kurtosis, Leptokurtic, Mesokurtic and Platykurtic frequency distributions.

9.2 Measures of Kurtosis based on moments.

9.3 Examples and Problems.

(12)

10. Correlation :

10.1 Bivariate data.

10.2 Concept of correlation between two variables, positive correlation, negative correlation.

10.3 Scatter diagram, conclusion about the type of correlation from scatter diagram.

10.4 Covariance between two variables ($m/_{11}$) : Definition. Computation, effect of change of origin and scale.

10.5 Karl Pearson's coefficient of correlation (r) : Definition computation for ungrouped and grouped data and interpretation.

Properties (i) $-1 \quad r \quad +1$ (with proof)

(ii) Invariant to change of orgin and scale (with proof)

10.6 Spearmen's rank correlation coefficient : Definition, computation and interpretation (with and without ties) derivation of the formula for without ties.

10.7 Simple problems and simple numerical examples

11. Regression : (14)

11.1 Lines of regression, fitting of lines of regression by the least squares method.

11.2 Regression coefficient (b_{yx}, b_{xy}) : Definition, computation

Properties : i) $b_{xy}\, b_{xy} = r^2$

ii) $b_{yx}\, b_{xy} \leq 1$

iii) $b_{xy} = r \frac{\sigma_y}{\sigma_x}$, $b_{xy} = r \frac{\sigma_x}{\sigma_y}$

iv) Effect of change of origin and scale.

v) Angle between the two lines of regression.

11.3 Explained and unexplained variation, coefficient of determination.

11.4 Nonlinear regression : i) Second degree curve ii) Exponential curve of type $y = ab^x$, fitting of such curves by least squares method.

11.5 Examples and Problems.

12. Theory of Attributes : (6)

12.1 Attributes : Notation, dichotomy, class-frequency, order of class.positive class-frequency, negative class-frequency, ultimate class-frequency, relationships among different class-frequencies (upto two attributes).

12.2. Concept of independence and association of two attributes.

12.3 Yule's coefficient of association (Q): Definition, Computation, interpretation

12.4 Examples and Problems.

13. Index Number :

13.1 Need of index number, general problems in construction of index number.

13.2 Computation and interpretation of price index numbers: Laspeyre's Paasche's and Fisher's index number.

NOTE : Numerical problems should have reference to real life situations.

BOOKS RECOMMENDED

1. Goon, Gupta and Dasgupta
Fundamentals of Statistics Vol. I & II.

2. S.P.Gupta
Statistical Methods.

3. Snedecor and Cochran.
Statistical Methods.

4. Croxton, F.E. and Cowden, D.J.
Applied General Statistics.

5. Walker and Lev.
Elementary Statistical Methods.

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Paper - II : Discrete Probability Distributions.

Objectives :

The main objective of this course is to introduce to the students the basic concepts of Probability, axiomatic theory of probability, concept of random variable, probability distribution (univariate and bivariate) of discrete random variables, expectete random variables, expectation and moments of probability distribution.

By the end of the course students are expected to be able

i) to distinguish between random and nonrandom experiments,
ii) to find the probabilities of events,
iii) to obtain a probability distribution of random variable (one or two dimensional) in the given situation, and
iv) to apply the standard discrete probability distributions to different situations.

Contents :

1. Permutations and Combinations : (5)

1.1 Permutations of n dissimilar objects taken r at a time (with or without repetitions) ${}^{n}P_{r} = \frac{n!}{(n-r)!}$: (without Proof)

1.2 Permutations of n objects not all of which are different.

1.3 Permutations under simple restrictions (circular permutations are not expected.)

1.4 Combinations of r objects taken from n objects. The notation $\binom{n}{r} = \frac{n!}{r!(n-r)!}$; (without proof)

1.5 Simple examples.

(10)

2. Sample space and events :

2.1 Experiments and random experiments, Ideas of deterministic and nondeterministic models.

2.2 Definitions of (i) sample space, ii) discrete sample space: finite and countably infinite, iii) event, iv) elementary event, v) certain event and vi) impossible event.

2.3 Concept of occurrence of an event.

2.4 Union and intersection of two or more events. Occurrence of i) at least one of the given events, ii) none of the given events, and iii) all of the given vents.

2.5 Mutually exclusive events, complementary events. (denote complement of event A by A')

2.6 Symbolic representation of given events and description of events given in symbolic form.

2.7 Examples and Problems.

3. Probability (15)

3.1 Classical definition of Probability.

3.2 Probability with reference to a finite sample space : Probabilitiy assignment approach. Probability of an event.

3.3 Equiprobable sample space, probability of an event.

3.4 Axioms of probability.

3.5 Probability of union of two events

$$P(A \cup B) = P(A) + P(B) - P(A \cap B).$$

statements of extension of this result to union of three or more events.

3.6 To prove (i) $P(A')$, (ii) If $A \subset B$, $P(A) \leq P(B)$, (iii) $P[\bigcup_{i=1}^{k} A_i] \leq \sum_{i=1}^{k} P(A_i)$, and (iv) $P(\bigcap_{i=1}^{n} A_i) \geq \sum_{i=1}^{n} P(A_i) - (n-1)$

3.7 Examples and Problems.

4. Conditional Probability and Independence of events : (12)

4.1 Definition of independence of two events.

$P(A \cap B) = P(A)\, P(B)$

4.2 Pairwise independence and mutual independence for three events.

4.3 Definition of conditional probability of an event.

4.4 Multiplication theorem

$P(A \cap B) = P(A).\ P.(B/A)$

4.5 Bayes's theorem

4.6 Examples and Problems.

5. Univariate Probability Distributions : (Defined on finite sample space) (10)

5.1 Definition of discrete random variable.

5.2 Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.) F (,) of a discrete random variable, properties of c.d.f./d.f.

5.3 p.m.f. of a function of a random variable.

5.4 Mode and median of a univariate discrete probability distribution.

5.5 Example and Problems.

6. Bivariate Probability Distributions (Defined on finite sample space) (10)

6.1 Definition of a two -dimensional discrete random variable, joint p.m.f.and joint d.f.

6.2 Computation of probabilities of events in bivariate probability distributions.

6.3 Concepts of marginal and conditional probability distributions.

6.4 Independence of two discrete random variables.

6.5 Probability distribution of functions of jointly distributed random variables.

6.6 Examples and Problems.

7. Mathematical Expectation.

7.1 Definition of expectation of a random variable, expectation of a function of a random variable.

7.2 Definition of expectation in bivariate distributions.

7.3 Theorems on expectation of sum and product of two jointly distributed random variables.

7.4 Conditional expectation in bivariate probability distributions.

7.5 Definition of mean variance of univariate distributions. Effect of change of origin and scale on mean and variance.

7.6 Definitions of conditional mean and variance in bivariate distributions.

7.7 Definition of coveriance and correlation coefficient in bivariate distributions. Distinction between uncorrelated variables and independent variables.

7.8 Definition of raw, central and factorial moments of Univariate probability distributions and their inter-relations.

7.9 Definitions of raw and central moments of bivariate distributions.

7.10. Examples and Problems.

8. Some Standard Discrete Probability Distributions :

8.1 Bernoulli Distribution : p.m.f. mean, variance, moments, distribution of sum of independent identically distributed Bernoulli variates.

8.2 Uniform discrete distribution on integers 1 to n : p.m.f. mean variance, situations where this distribution arises.

8.3 Binomial Distribution : $b(r,n,p) = \binom{n}{r} p^r (1-p)^{n-r}$, binomial variate $X \sim B(n,p)$, recurrence relations for successive probabilities, computation of probabilities of different events, mode of the distribution, mean, variance, moments, skewness (comments when $p = 0.5$ 0.5, p 0.5) additive property of binomial variates, distribution of X, given $X+Y=n$, where X and Y are independent $B(n_2, P)$ variates.

8.4 Hypergeometric distribution :

$$P(X=r) = \frac{\binom{M}{r}\binom{N-M}{n-r}}{\binom{N}{n}}, \quad r = 0,1,2 \ldots p \text{ or } M \text{ whichever is smaller.}$$

p.m.f. computation of probabilities, situations where this distribution is applicable, binomial approximation to hypergeometric probabilities, mean and variance of the distribution.

8.5 Examples and Problems.

BOOKS RECOMMENDED

1. Hogg, R.V. and Craig, R.G.
Introduction to Mathematical Statistics.

2. Hoel, P.G.
Introduction to Mathematical Statistics.

3. Feller, W.,
Introduction to Probability Theory and its Applications, Vol.I.

4. Mood, A.M. Graybill, F.A. Boes, D.C.
Introduction to Theory of Statistics.

5. Meyer, P.L.
Introduction to Probability and Statistical Applications.

PAPER III : PRACTICAL

Prerequisites : Knowledge of the topics in Theory Papers.

Objectives :

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 compute correlation coefficient, regression coefficients, iii) to fit binomial distribution, iv) to analyse data pertaining to discrete and continuous variables and to interpret the results, v) to compute index number, and vi) to compute probabilities of bivariate distributions.

Sr. No.	Topics of Experiments.	Number of Experiments.
1.	Use of random number tables: To draw samples by using SRSWOR, stratified, systematic sampling methods.	(1)
2.	Tabulation (one, two and three factors of classification) and diagramatic representation (problems based on Bardiagrams : vertical, subdivided and pie-diagram.)	(2)
3.	Graphical representation of statistical data (problems based on histogram : with equal and unequal class-width, frequency polygon and curve, ogive-curves.)	(1)
4.	Computation of measures of central tendency -I	(1)
5.	Computation of measures of central tendency -II (use of an appropriate measure of central tendency and interpretation of results) and computation of partition values.	(2)
6.	Computation of measures of dispersion 1	(1)
7.	Computation of measures of dispersion-11 (use of appropriate measure of dispersion)	(1)
8.	Raw and central moments for ungrouped and grouped data (with Sheppard's corrections).	(2)
9.	Computation of measures of skewness and kurtosis	(1)
10.	Scatter diagram, fitting of lines of regression and computation of correlation coefficient (ungrouped data)	(2)
11.	Fitting of lines of regression and computation of correlation coefficient (grouped data.)	(1)